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Riter-Conley Manufacturing Company

STEEL CONSTRUCTION

Pittsburgh

INDEX TO CONTENTS, PAGE 256.

ADVERTISERS' INDEX, PAGE 24

KOPPERS

BY-PRODUCT COKE OVEN

SURPLUS GAS

THE yield of surplus gas from the new KOPPERS coke oven plant of the LACLEDE GAS LIGHT CO. at St. Louis has never been equalled by any other coke oven plant.

H. KOPPERS COMPANY

Builders of

By-Product Coke and Gas Ovens

Pittsburgh, Pa.

THE AMERICAN
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NEW APPARATUS FOR THE MANUFACTURE OF AQUA AMMONIA FROM RAW GAS LIQUOR.

By R. W. HILGENSTOCK, Chief Engineer, Poetter G.m.bH., Düsseldorf (Germany).

Owing to the great demand on ammonia for the manufacture of nitric acid in this country, the manufacture of concentrated ammonia liquor and aqua ammonia has drawn considerable interest. While the manufacture of concentrated ammonia liquor is comparatively easy and only few apparatus are needed, the manufacture of aqua ammonia, if to be absolutely pure, is much more difficult. Carbonic acid, sulphuretted hydrogen and the empyreumatic compounds must be taken out entirely. By means of alkalis, carbonic acid and sulphuretted hydrogen may be bound, so that they will not be absorbed with the ammonia gases; but it is an expensive process, to say nothing of the unpleasant residues, specially when lime is used. The city authorities are always anxious to know how these residues are taken care of, and the sanitary offices often make trouble, because they fear contamination of the rivers and wells.

To avoid these troubles as much as possible, the utmost care had to be taken in design and manufacture of new apparatus. The question also rose whether the lime or other alkalis, used, could not be replaced by other materials. They have been found in the heat and the alkaline properties of the ammonia gas itself. Carbonic acid and sulphuretted hydrogen form compounds with the ammonia, that can be decomposed very easily by heat; and on the other hand, the ammonia very readily re-unites with carbonic acid and sulphuretted hydrogen.

These particular properties are the base of the apparatus described in the following pages which is built by the "Poetter G.m.b.H., of Düsseldorf, Germany."

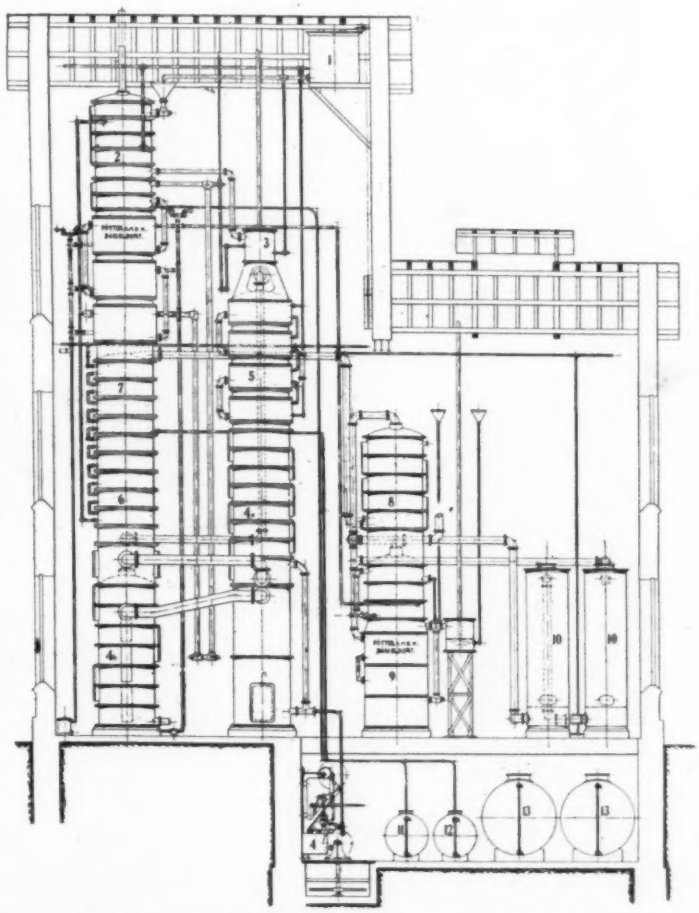

Fig. 1.—General Arrangement of Aqua Ammonia Plant.

The general arrangement of an aqua ammonia plant of the "Poetter type" is shown in Fig. 1. The raw liquor to be worked up, is pumped into the feed-tank, 1, which, at the same time, acts as a regulator for the equal flow of the liquor into the carbonic acid extractor. For pumping the liquor from the storage well to the feed-tank, it is advisable to provide a motor driven centrifugal pump, and by a valve or cock in the discharge line, it is easy to regulate the flow of liquor to the tank.

In the carbonic extractor, 2, the greatest part of the carbonic acid is contained in the gas liquor in the form of carbonate of ammonia, is to be taken out. This takes place in the lower part of the apparatus, and for this purpose there are three rectangular heating chambers, in which the gas liquor is heated to 98–100° Cels. The proper decomposition temperature is in the neighborhood of 93°, so this temperature is sufficient for the lowest heating chamber, but in order to decompose almost all the carbonate of ammonia, and thereby extract the major part of carbonic acid, it is necessary to keep the temperature nearly 100° Cels.

At this high temperature, of course, a great deal of the ammonia is driven off also, and in order to regain it and prevent losses, a number of absorption chambers are placed on top of the upper heating chamber, in which the ammonia is reabsorbed from the liquor, which again flows into the heating chambers. The absorption of the ammonia is absolutely perfect, so that the waste gases that leave the apparatus contain only air, carbonic acid, sulphuretted hydrogen and pyridin. To prevent the formation of vacuum in the apparatus, a vacuum breaker, 3, is attached, which admits air from the outside if minus pressure is produced.

From the lower heating chamber, the preheated and decarbonized liquor flows into the upper section of the still, 4a, in the upper sections of which all volatile ammonia compounds, and the last carbonic acid and sulphuretted hydrogen are eliminated. In the liming leg, which is below the sections for volatile ammonia, the liquor is thoroughly mixed with milk of lime, pumped from the lime mixing vessel, 4; the lime causes the decomposition of the so called "fixed" ammonia—salts, i. e., sulphate of ammonia, sal-ammoniac, nitrate of ammonia, etc. In order to drive off the ammonia, set free by this reaction, the mixture of liquor and milk of lime is led into the secondary still, 4b, composed of several sections, similar to those of the primary still. The steam-ammonia vapors pass the primary still with the vapors set free in this part of the apparatus, and enter the condenser, 5, on top of the primary still; and, due to the special construction of this apparatus,

which consists also of several individual chambers, the ammonia gases are almost entirely freed from the steam vapors, so that a nearly dry ammonia gas enters water washer, 6.

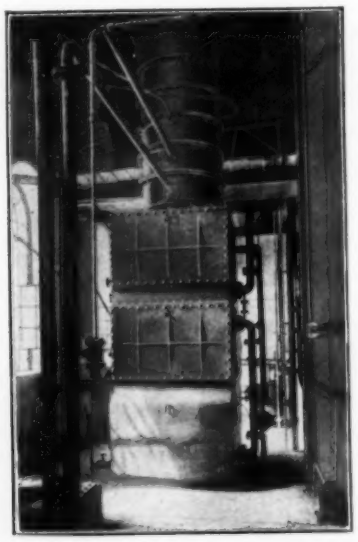

Fig. 2.—Carbonic Acid Extractor.

In this washer the remaining carbonic acid and sulphuretted hydrogen in the ammonia gases are to be extracted; a number of sections, similar to those of the still, being provided for this purpose. In each section the ammonia vapors are distributed over a large washing surface, causing a thorough washing of the gases. The washing fluid is clear water, which enters the upper section and travels down from section to section. A certain part of the ammonia is absorbed by the water, so that a saturated solution of aqua-ammonia is formed. The ammonia in this solution retains the last parts of carbonic acid and the sulphuretted hydrogen, forming carbonate and sulphate of ammonia, respectively. The gases leaving the washer contain, if any, only traces of CO_2 and H_2S. The feed of the washing water is regulated, so that just enough water enters the washer to absorb sufficient ammonia to retain the carbonic acid and sulphuretted hydrogen. It is, therefore, only necessary to test the ammonia gases, from time to time, at the outlet of the washer, with a solution of calcium chloride and a solution of acetate of lead; in the first solution no precipitation must show, and the latter solution must not discolor when brought in contact with the ammonia gases.

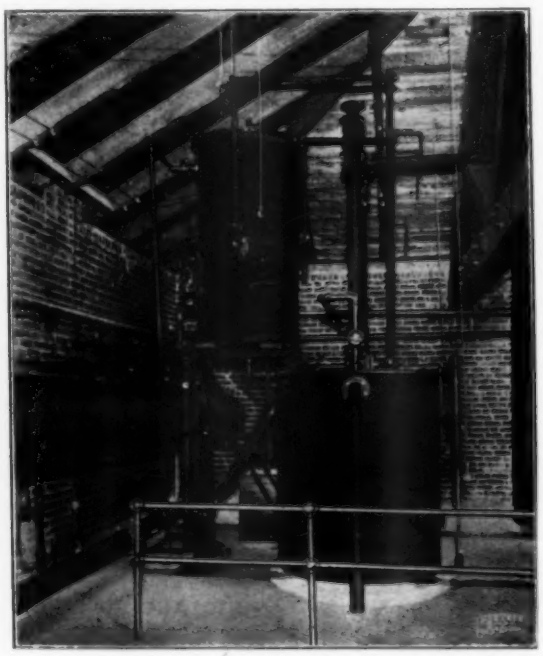

Fig. 3.—Reversing Absorption Apparatus.

The waste-wash water, a saturated solution of carbonate and sulphide of ammonia, is led into one of the cylindrical tanks, 11 or 12, from where it is forced in thin streams by means of compressed air, into the carbonic acid extractor, where a decomposition of the volatile ammonia compounds takes place again, carbonic acid and sulphuretted hydrogen are eliminated, while the ammonia is absorbed by the gas liquor. To prevent any CO_2 and H_2S being retained in the ammonia, in case trouble occurs in the operation of the apparatus, another washer, 7, is placed above the water washer. Its construction is exactly the same as that of the water washer, but instead of water, a 15° Bé. solution of hydrate of sodium is used as washing fluid, and any CO_2 and H_2S contained in the ammonia gas are taken up by the sodium solution, forming carbonate of soda and sodium sulphide. The waste washing fluid from the lower section of this washer is led to the storage liquor-well, as only small quantities are produced.

The ammonia gas so far purified, still contains some tarry matters and some pyridin that must be taken out. For this purpose an oil washer, 8, is provided, similar in its construction to the other washer. It consists of a certain number of sections in which the ammonia gases come into intimate contact with the washing fluid, in this case a heavy tar oil. After this third washing the ammonia is sufficiently pure; so it can be absorbed in distilled water in the absorbing apparatus, when so-called "technical aqua ammonia" is to be manufactured.

Fig. 4.—Still with Cooler, Water, Alkali and Oil Washer.

This absorbing apparatus, 9, is the same in construction as the carbonic acid extractor, 2. Instead of steam, cooling water is used in the 3 rectangler chambers, to prevent a rise of temperature in the absorbing water, due to the reaction heat. According to the quantity of distilled water fed into the upper part of the apparatus, aqua ammonia, higher or lower in the percentage of ammonia, is the end product. The advantage of this apparatus is that the finished aqua ammonia flows out continuously, a changing of the absorbing vessels, as is the case with other apparatus, is therefore not necessary. The distilled water for the absorbtion, is removed from the heating chambers of the carbonic acid extractor, the condensed steam being led through a cooler and into a storage tank. A steam trap is placed in the exhaust line from the coils in the chamber, so that only condensation, and no live steam, can get out.

When chemicully pure aqua ammonia is to be manufactured, a further purification of the ammonia gas is necessary, which purification takes place in the charcoal and bone black filters, 10. Four wrought iron filters are installed, two filled with charcoal, and two with bone-black, and the gas passes the charcoal fitters first, and then those filled with bone-black. The charcoal, as well as the bone-black, can be regenerated several times before they are used up. Before each regeneration, the ammonia retained in the filter material must be driven off by steam, and led back into the lower

cylindrical section of the carbonic acid extractor, in which it is absorbed again by the raw ammonia liquor.

Fig. 2 shows a carbonic acid extractor used in a large chemical plant for decarbonizing 100 cbm. of gas liquor in 24 hours.

Fig. 3 is an absorbing plant of the reversing type. There are two lower cylinderical vessels (in the illustration only one can be seen, as the second is behind the one seen.) The purifying ammonia gas passes the lower vessels in succession and finally the upper apparatus, which is divided into two compartments again, so that practically a fourfold absorption takes place. When the aqua ammonia in the first lower vessel has the desired percentage of ammonia, the gas flow is reversed, so that the ammonia enters the second lower vessel first. The first vessel is quickly emptied, and filled again with distilled water from the sections of the upper vessel; the latter is replaced by fresh distilled water. When the batch in the second lower vessel is finished the process is repeated.

Fig. 4 shows a water, alkali and oil washer joined in succession; this arrangement had to be chosen on account of the space available in the building. Behind the washers the primary still with the cooler on top can be seen.

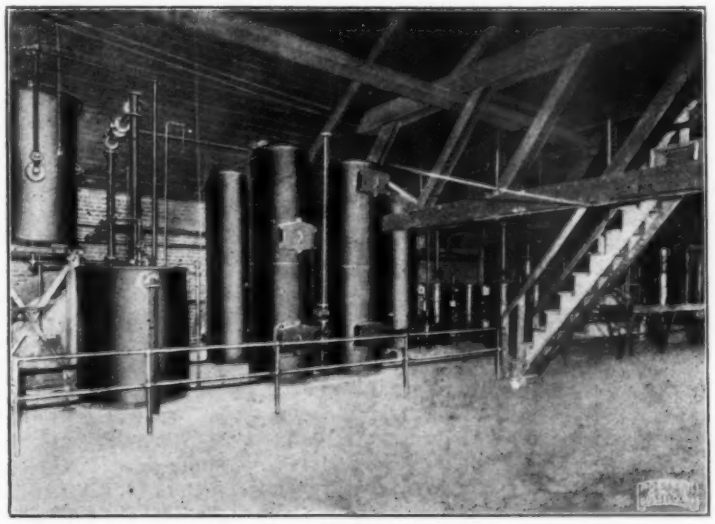

Fig. 5.—General Arrangement of Aqua Ammonia Plant with Reversing Absorption Apparatus.

In Figure 5 the general arrangement of a smaller aqua ammonia plant with absorbing vessels of the reversing type is shown. The still, washers and filters had to be arranged in succession also, because the available height of the building was not sufficient to allow the different apparatus to be placed on top of each other.

Finally, I give a table showing the operating costs and profits of a large aqua ammonia plant.

Operating Costs and Profit for an Aqua Ammonia Plant Working up 100 cbm, of Gas Liquor, Containing About 2% Ammonia, per 24 hours.

A. Expenses.

1. a. Interest and amortization for the building, *i. e.*, 5% for interest and 3% for amortization—total, 8% of M. 40,000 ..... M. 3.200
   b. For the apparatus—5% for interest and 10% for amortization—15% of M. 60,000 ..... M. 9,000
2. *Costs for Steam.*—For each cubicmeter of gas liquor worked up 275 kg. are needed; the yearly amount of steam would be, 275 x 100 x 300 = 8,250,000 kg. Figuring that 1 kg. coal will evaporate 7 kg. of water, there would be needed 8,250,000 : 7=1200 tons. The price of one ton is M. 20—consequently an expense of 1,200 x 20= M. 24,000
3. *Lime Consumption.*—For each kg. ammonia in the gas liquor, 0.7 kg. of good lime is needed. Figuring 20 kg. ammonia in 1 cbm. of gas liquor, the total amount of ammonia would be 20 x 100 x 300 = 600,000 kg.; this would mean a lime consumption of 60,000 x 0.7 = 42,000 kg. The selling price of lime being M. 1.70 for each 100 kg., we had to consider 42,000/100 x 1.70 ..... M. 7,140
4. *Cooling Water.*—For each cbm. of gas liquor 2 cbm. of cooling water are needed. In 300 working days the total amount would be 100 x 2 x 300 = 60,000 cbm.; the cbm. will cost about 0.05 Mk., consequently an expense of 60,000 x 0.05 ..... M. 3,000
5. *Consumption of Alkali (Sodium Hydrate.)*—When sodium hydrate of 70% is used, it can be assumed that each kg. of ammonia in the gas liquor requires from 10 to 15 gramms of sodium hydrate, averaging 12.5 gramms. 600,000 kg. ammonia are worked up, so 600,000 x 12.5 = 7,500 kg. are necessary. 100 kg. of the material cost about M. 20—amounting to a total of 7,500/100 x 20 ..... M. 1,500
6. *Oil—Consumption.*—Actual operating figures show the consumption of oil is about 0.01 to 0.02 kg. oil for each kg. of ammonia, an average of 0.015 kg. The total consumption, therefore, would be 600,000 x 0,015 = 9,000 kg. The price of oil being M. 35 for each 100 kg., the expenditure would be 9,000/100 x 35 ..... M. 3,150
7. *Charcoal and Bone—Black.*—The consumption of these materials depends upon the composition of the gas liquor, and the impurities that must be taken out. The expenses, however, should be covered with 0.5 Pfg. for each kg. of ammonia, so that we had to figure with 600,000 x 0.05 ... M. 3,000
8. *Wages.*—To operate the apparatus, wheeling the lime and preparing the milk of lime, 6 men are needed for 24 hours; two of these are operators, each with M. 6, and 4 helpers with M. 5 each; the yearly wages would, therefore, amount to 32 x 300 ..... M. 9,600
9. *Miscellaneous.*—For repair work, packing, cleaning, oil and other material, light and cleaning, costs can be figured ..... M. 1,200
10. *Raw Gas Liquor.*—For each kg. of ammonia contained in the gas liquor, M. 0.60 can be figured, so that the total expenditure would amount to 600,000 x 0.60 ..... M. 360,000
11. *Losses.*—For unavoidable losses 3% of the amount in item 10 has to be considered ..... M. 10,800

Total ..... M. 435,590

Receipts.

The selling price of the kg. ammonia contained in the aqua-ammonia is M. 0.90, so that the total receipts would be 600,000 x 0.90 ..... M. 540,000

Recapitulation.

Receipts	540,000 Mk.
Expenses	435,590 Mk.
Net earnings	104,410 Mk.

The price for the raw ammonia liquor in item 10 is f.o.b. work, so that eventual freight charges had to be added.

It had to be considered also if it would not be of advantage to buy the liquor in concentrated form, with about 20% of ammonia; in this case the kg. of ammonia would cost M. 0.80 f.o.b. works.

When "technically pure ammonia" is to be manufactured the expenses in item 7, amounting to M. 3,000, can be omitted.

Accidents that Could have been Prevented.

Compiled by J. B. DOUGLAS.

An employee working in a coal conveyor gallery violated the rule requiring the use of goggles, and advanced as a reason that he had expected to be there but a short time. His reason was not good, and did not prevent a piece of flying coal becoming imbedded in his eye. It is always best to be careful first.

A fitter, setting a meter, failed to make the usual test after turning on the gas; and consequently did not discover a leak that caused a personal injury to the consumer and damage to his property when a lighted match was used to search for it. Forgetfulness has caused many a catastrophe; so be careful not to forget to perform all of your duty.

A gin pole was left lying in such a position that it protruded into a roadway between two building in a works' yard, with the result that an employee fell over the hole and was injured. No reason except inexcusable carelessness.

[Continued from Page 230.]

THE ASTORIA TUNNEL UNDER THE EAST RIVER FOR GAS DISTRIBUTION IN NEW YORK CITY.

The Tunnel Flooded—The Work of Recovery—Unwatering—The Steel Lining—Quantities of Material—The Gas Mains—Laying and Testing—The Men who Conceived and Executed this Undertaking.

From the paper by JOHN V. DAVIES, to the American Society of Civil Engineers.

Shortly after 8 A. M., Sunday October 5, a large flow of water, carrying green sand, burst from the top of the rock bench about 15 feet from the Astoria emergency bulkhead. After flowing 30 minutes it abruptly ceased, only to burst forth a few minutes later with renewed vigor, yielding approximately 10,000 gallons per minute, which soon overcame the capacity of the pumps at the Astoria end. The bulkhead doors were promptly closed. On the Bronx side the force of water was broken by the intervening heading bulkhead still in place, and the workmen were able to close the drains; but, on the Astoria side, owing to the rush of water and sand, they were able to close only two of the three drain valves in the bulkhead. It was found later that a small piece of 1″ board had become wedged between the door and the door frame of the bulkhead on the Astoria side. Through these openings the water poured into the tunnel, carrying with it a large volume of sand and debris. The water in the Astoria shaft rose steadily until, at 3:15 P. M., it submerged the pumps, and reached tidal elevation at 8:15 P. M., on Monday, October 6th.

The Bronx emergency bulkhead was strengthened as a further measure of safety by a reinforced central buttress, and an additional bulkhead was built about 105 feet nearer the Bronx shaft. No need of this bulkhead arose, as the first one withstood the pressure, but it was desired to take every possible precaution against the flooding of the remaining protected tunnel, as the unwatering of an entirely flooded tunnel would have been a much more difficult proposition.

Recovery of Tunnel.—It was observed that the water rose and fell in the Astoria shaft with the tide, but that the rise was only about one-half that in the river. From the continuance of these conditions it was apparent that the water flow had not choked itself as had been hoped. After due consideration it was decided to grout from the Bronx end into the water-filled chamber between the Astoria and Bronx bulkheads, with the object of filling this with cement to the extent of permitting the unwatering of the tunnel from the Astoria end. At the same time diamond-drill borings were to be driven from the Bronx bulkhead, to intercept the fissure at a point beyond its opening into the tunnel, and through this to inject cement to seal the source of flow. The first hole drilled was intended to tap the fissure 5 feet below and 5 feet beyond the point of the flow into the tunnel, this location determined by a close study of the geological formation previously encountered. This hole measured 120 feet from the bulkhead face to the point, and the accuracy was proved, not only by the injection of 870 bags of cement, but by the conditions disclosed when driving through this section in February, 1914. The grout was well directed into the fissure, but naturally followed the line of least resistance, going no further than the debris in the fissure would permit.

The second step was to fill completely this space between the completed arch and the rock bench between the bulkheads, and began by drilling through the Bronx bulkhead and the small disused heading bulkhead with a diamond drill, using a packing tube fitted with an exterior valve inserted in the bulkhead, through which the diamond drill rods were threaded and operated. These drill rods were pushed into the chamber, as near as possible, to the fissure location. Grouting through this tube began at 3 P.M., on November 10th, and continued without interuption until 4 P.M., on Nov. 12th, 8,580 bags of cement being injected, at a pressure of 400 pounds per square inch. The grouting was discontinued on the appearance of cement in the seepage around the Bronx bulkhead door.

From the action of the water in the Astoria shaft, it was evident that the grouting had scaled, to a large degree, the direct passage and subsequent leak between the tunnel and river, but had not entirely sealed the leak though the Astoria bulkhead, as the draining of water through numerous small pipes in the Bronx bulkhead lowered the water in the Astoria shaft some 17 feet. The water receding in the Astoria shaft, resulted in unequal pressures on the freshly injected grout in the fissure, so that, when an absolute pressure of 11 pounds existed on the fresh grout, it gave way, causing the water from the fissure to flow again into the tunnel, and the shaft water to rise.

Meanwhile, the long tubing was kept free, both inside and outside, and withdrawn to within 7 feet of the inner bulkhead wall. It was again pushed forward in the morning of November 14th, and 775 bags of cement injected. Later the same morning, 622 bags were injected, followed in the afternoon by 986 bags. On the following morning 316 bags were injected, when the pressure gauge on a pipe extending through the bulkhead began to jump in excess of the hydrostatic pressure, and grout began to appear through the bulkhead pipes. However, on November 17th, an additional 164 bags were injected through this tube, making a total of 11,342 bags of cement.

Meanwhile, the diamond drill borings had been continued, and, although water and green sand were encountered, only a small quantity of cement could be injected. It was evident, later, on removing this piece of bench, that the fissure in question was pierced only by the first drill hole. By opening pipes in the Bronx bulkhead it was found that they gave water, but without pressure, and, therefore, it was considered quite safe to commence unwatering the tunnel from the Astoria end.

As the heading had been entirely carried through, and the test borings had defined quite clearly the position of the seams, it was thought that, if the plan of drilling with diamond drills and grouting, as described, did not prove successful, a steel trestle could be erected over the tunnel on the bed of the river, and from the deck above high-tide, drill holes could be placed to intercept the line of the seam, and grouting executed at any pressure desired, which would be amply adequate to fill the seam and plug it effectively. Fortunately, this expedient was not found necessary.

Unwatering.—In the Astoria shaft, prior to the flooding, were an 18-inch ventilating pipe (extending from the surface, down the shaft, and into the tunnel a distance of 970 feet), and three 8-inch discharge lines (extending from the pumps at the foot of the shaft to the surface). These four pipes were converted into a pneumatic waterlift system by placing a 3″ air pipe inside the 18″ ventilating pipe, to a depth of 240 feet below mean sea level, and a 2″ air pipe inside each of the 8-inch lines to the same depth. The discharge ends of the air lines, for some 24 inches, were perforated with small holes, drilled at an angle of 45°, so that the air discharge would point upward. These air lifts all discharged at the shaft surface, and were the only means used to lower the water 176 feet from the top of the shaft, and down to that depth, proved rapid and effective.

On a steel pontoon floating in the shaft, were placed two pumps (of 1,000 and 800 gallons per minute) with the discharge connected to an 8″ discharge line in the shaft, and three 600-gallon pumps were placed in the elevator wells after the water had been lowered 172 feet below mean sea level. These pumps were lowered from time to time as the water dropped, and, when it was 13½ feet above the tunnel invert at the shaft, the submerged permanent pumps were brought into play.

The 18″ and two of the 8″ air lifts were operated continuously from 8 A.M. to 9 P.M., on November 24th, when the water had been lowered a depth of 160 feet, displacing 1,147,028 gallons in 797 minutes, or an average discharge of 1,439 gallons per minute. The two pumps on the pontoon were then started and worked continuously until 6 A.M., on November 25th, with a net gain of 15 feet. The three pumps in the cage wells were then operated, it being necessary to change the pipeline connections quite frequently. On November 30th, at 10:40 A.M.. the water was 13½ feet above the tunnel invert at the shaft portal. During this stage of the pumping, in order to avoid a column of water forming at the Astoria bulkhead and a consequent probable regurgitation of the water in the shaft, air under pressure was forced into the tunnel through a 2″ pipe, which was in place and extended from the sur-

face about 3,200 feet into the tunnel. At 10:40 A.M. on November 30th, the original shaft pumps were started, and the water was quickly drained from the tunnel. During the period occupied in pumping at the Astoria end, a 2″ and 5″ pipe in the Bronx bulkhead were kept flowing, and materially aided in the unwatering.

On Sunday evening, November 30th, with the water 4½ feet below the crown of the arch at the portal, engineers in two boats inspected the tunnel up to the Astoria bulkhead. It was found that comparatively little damage had been done by the flooding, although considerable grout and sand had entered through the door that, in the inception of the flood, was not securely closed, and through the 8″ drain which the men had been unable to close. Sand deposits occurred at frequent intervals throughout the first 2,300 feet, and beyond this a layer of sand, mud, coal, shells, etc., covered the tunnel invert increasing toward the bulkhead. At 3,000 feet from the shaft, the grout, with a small proportion of sand, formed a bank 12″ deep, gradually sloping up to the bulkhead, a length of about 500 feet, where it was 12 feet thick, or nearly to the top of the bulkhead doorway. The surface of this grout bank was in a plastic condition, some 6″ deep, the underlying material being firm and semi-hard, the hardness increasing toward the bulkhead. This material was not well set-up grout by any means, the subsequent removal being performed with pick and shovel. From the 8″ drain clear water, at the rate of 900 gallons per minute, was flowing, and from a 3″ cable conduit pipe in the bulkhead there was a stream of 100 gallons per minute—neither being under pressure.

The construction of an emergency bulkhead about 60 feet from the closed bulkhead was immediately commenced, before making any attempt to remove the aforesaid grout bank, as the appearance and condition of the grout bank material were such as to cause grave doubt that the leak would remain confined. A small trench was excavated in the grout bank around the bulkhead drains; the two closed ones were blind-flanged and the open one was allowed to flow, in order to prevent any additional pressure on the bulkhead.

Simultaneously with the construction of the emergency bulkhead, the cleaning and righting of the tunnel proceeded. Meanwhile, emergency pumps were erected at the shaft bottom and the original pumps overhauled. When this work was completed the Astoria plant consisted of fifteen pumps, with a combined rated capacity of 9,600 gallons per minute, which was considered quite sufficient to handle any likely flow.

The method adopted for completely sealing the water flow consisted in driving a series of long test holes, in an effort to pierce the fissure well outside of the tunnel lines, through which effective seal and solidification of the rock mass would be obtained by injecting grout. The short holes were drilled with percussion drills and the long ones with diamond drill equipment through the tunnel side-walls close to the bulkhead, as it was desired not to disturb the latter in any way. The first hole drilled to the computed depth encountered water at full pressure at a depth of 22 feet; the success of this hole was very encouraging, as it had been computed that water would be encountered at 21½ feet.

The results attained in grouting were observed by pressure gauges on the Astoria and Bronx bulkheads, and by allowing the pipes in the Bronx end to remain flowing. Grouting began at 1 P. M. on December 18th, and was followed immediately by the appearance of grout in the flowing Bronx pipes, indicating that the point of injection communicated with the water hole of October 5th, and that the latter was still unsealed. At 9 P. M. on December 19th, after the injection of 3,360 bags of cement, the hole refused to take any more.

It was quite apparent that the grouting had been effective; but, during the time necessary to allow it to set thoroughly, it was decided to make a thorough investigation of the underlying rock before attempting to open up the grout-filled chamber between the bulkheads. This investigation consisted of drilling ten long diamond drill holes; and though the rock structure outside the tunnel lines was found to be extremely disintegrated, no water was encountered—a favorable indication of the success of the last grouting.

On January 5th, 1914, the work of removing the grout fill between the bulkheads commenced. A small drift was driven through the Astoria bulkhead, after which the door was raised and put in working order. The Bronx bulkhead door was raised on January 15th, 1914, and preparations were made for resuming the bench excavation—after a delay of 102 days, caused by the flooding of the tunnel.

The grout fill removed was in an unusual condition of stratification. Certain layers were extremely hard, and others soft; some sections were highly stratified—others massive; some layers and masses of what might be described as solidified "laitance" were found that never attained a greater hardness than that of soft chalk, having a chemical composition entirely different from that of the Portland cement from which it had been produced. Layers of sand also extended through the mass, and, in the vicinity of the water hole, a 4-foot blanket of coal, sand, shells, bits of wood, etc., was disclosed. No indications of water were apparent, other than the usual normal seepage through the concrete lining.

Several interesting conditions were encountered during the recovery of the flooded tunnel. Although large quantities of sand, coal, bits of wood, etc., were found, having been washed into the tunnel, and thus establishing proof of a direct connection with the river bed, no fish were found, though during previous heading flows many live fish, up to 8″ in length, were washed in.

Of unusual interest is the fact that, though the total cement injected from both ends, from the time of the flood to the completion of the grouting, was only 595 cubic yards, about 1,150 cubic yards of solid grout were removed, in addition to 400 cubic yards of sand shells, coal, etc.; to say nothing of the grout that remained in the fissures. A possible explanation of this is that in some manner the injected cement had mixed with fine decomposed dolomite, probably in sediment in the water, and that cement in the form of grout does not act as normal Portland cement in maintaining constant volume.

In view of the recent flooding, it was resolved to exercise even greater precautions than heretofore. After careful consideration, a method of attack was devised which ultimately proved quite successful, This consisted of: (*a*) the construction of an inverted concrete arch over the remaining length of bench between bulkheads; (*b*) an even more thorough exploration of the underlying rocks with test holes as long as could be drilled by percussion drills; (*c*) the injection of cement through these holes in an effort to solidify the rock mass—the inverted arch acting as a resistance to this grouting; (*d*) the careful excavation of the exposed rock by very light blasting of small sections only; and (*e*) the immediate concreting of the tunnel lining on completing a short length of full section excavation.

The inverted arch was 24″ thick and 8½ feet below the concrete tunnel arch on the center line. As this working space did not permit of drilling to the tunnel invert extrados, the exploration was accomplished by first testing to a depth of from 5 to 6 feet below the inverted arch. Drilling pits were then excavated and concrete-lined as an inverted arch, well bonded into the tunnel arch and the inverted arch slab. Test drilling was then done from these pits, reaching well outside of the necessary lines of excavation.

In removing this 122 feet of bench, all the rock encountered was extremely wet, and, although two flows of fair volume occurred, no unusual difficulties were experienced. The numerous injections of grout had been quite effective in consolidating the disintegrated rock structure. On uncovering the water-hole of October 5th, it was found to be a green sand seam, 24″ wide, and of unknown depth, filled with sand, coal, shells, etc., through which a 9″ layer of hard grout extended. No water was flowing, nor was there any further trouble from this fissure.

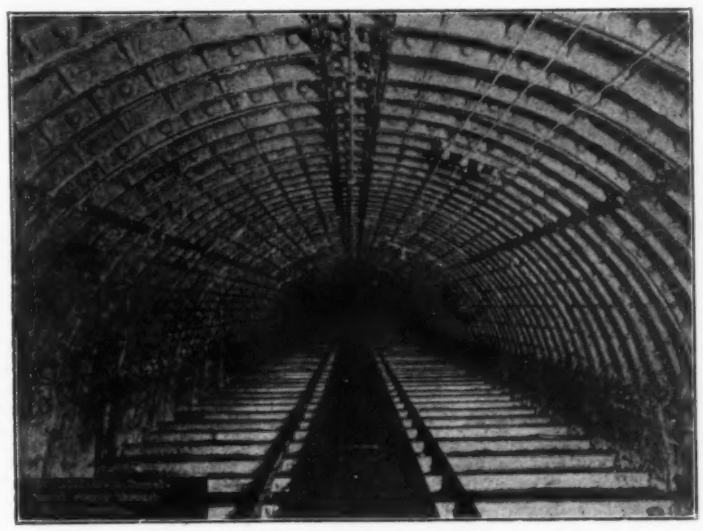

Fig. 8.—Tunnel Runway through Cast-Steel Ring Section.

Steel Lining.—Following the completion of the bench excavation, the erection of the cast-steel ring lining began, to secure im-

permeability for some 400 feet of wet rock section extending on each side of the existing 50 feet length of cast iron rings. Being an after consideration, it was devised for its adaptability to the existing conditions. In contrast to the 50 feet section of iron lined tunnel, the rock structure of this zone was so treacherous and shattered, that it would have been extremely hazardous to increase the area of excavation necessary for the insertion of circular rings.

The usual assumption for a metal lining of a subaqueous tunnel is that it is surrounded by a more or less plastic medium, and that no inward collapse can occur at any point without an outward distortion at other points on the periphery; usually, the most suitable section to meet these conditions is circular. In this case, however, the tunnel was embedded in rock and of horse-shoe section, and the spaces between the metal lining and the rock would be solidly filled with concrete or cement grout, which would support the metal lining and prevent any distortion of the lining.

On account of the hydrostatic pressure, and the departure from a true circular form, such stresses were produced in the metal that, without very wasteful design, cast iron could not be considered feasible for the resultant pressures, and it appeared necessary to substitute cast steel.

The cast-steel segments used were made by the Wheeling Mold & Foundry Company, in accordance with specifications of the American Society for Testing Materials; machined on all flanges to exact templates, so that all segments of the same letter were interchangeable.

This cast-steel lining was of segmental form, shaped to the neat lines of the tunnel, with the extrados 7 inches beyond these lines. As the flange depth of the rings was 6 inches, and it was not desired to increase this depth at the expense of cutting away more of the concrete lining, there was an allowance of only 1 inch of concrete over the ring flanges, in covering the lower segments up to the springing line of the arch, being simply a protection against corrosion and to produce a smooth surface for the interior of the tunnel.

In consideration of the possible danger of causing serious water flows in removing the concrete lining necessary for the erection of the steel lining, it was decided to do it without blasting by taking off the necessary 9 inches by bull-pointing with small air-driven jack-hammers.

The rings were grommetted and caulked on the completion of the grouting. In grommetting, which was carried on immediately in advance of the caulking, each bolt was wrapped with strands of hemp, not coated with any water-proofing substance, as is usually the practice, as it was determined by experiment that the results derived from pitch-dipped hemp were not better than with the uncoated strands. n caulking the ring joints, small air-driven caulking hammers were used, the procedure consisting simply of turnover the metal edges of the joint, as though caulking a boiler. In unusually wet places, lead wire was used to stop the flow temporarily, until the edges were turned. This 400-foot of steel-lined tunnel is now practically water-tight, although occasional drops are caused by the natural sweating of the metal. This, in time, will probably gradually dry up and disappear entirely, due to the corrosion of the metal and the silting in of fine particles of matter.

Drainage.—The completion of the tunnel, with the entire lining, left seepage water to be taken care of by the permanent drainage, and pumping of 280 gallons per minute, this seepage coming in from the entire length of the tunnel and the two shafts, including the enlargement at the foot of the Astoria shaft, or a surface area of approximetely 36,000 square yards. This inflow, for the most part, is through the jointing of the rock in the hardest portions af the granitic gneiss, including the Astoria shaft and the tunnel extending from that shaft to the dolomite rock contact. The softer dolomite is, for all practical purposes, perfectly dry, and there is practically no water finding entry through the section lined with steel plates. The remainder of the inflow originates in the similar hard gneiss constituting the Bronx shaft, and the section of the tunnel between the bulkhead line of the East River and the westerly contact.

Quantities and Costs.—The following table is a summation of the quantities incidental to the shaft and tunnel construction.

Summation of Quantities.

Earth excavation, for erecting plant	1,750	cu. yd.
Earth excavation, shafts	3,050	"
Earth excavation, total	4,800	"
Rock excavation, shafts	17,480	"
Rock excavation, tunnel	70,140	"
Rock excavation, total	87,620	"
Concrete removal, tunnel	4,080	cu. yd.
Grout bank removal, tunnel	1,150	"
Summary of excavation—earth rock, concrete, etc.	97,650	"
Concrete, plant foundations	1,160	"
Concrete, shaft lining	5,070	"
Concrete, tunnel	20,860	"
Concrete, tunnel bulkheads	2,070	"
Concrete, pipe foundations	710	"
Summary of concrete placed	35,870	"
Lining rings, 20 cast-iron, 50 lin. ft	227½	tons*
Lining rings, 200 cast steel, 400 lin. ft	1,356	"
Lining rings, total, 220 rings, 450 lin. ft	1,592½	"
Cement, concrete plant foundations	6,870	bags
Cement, concrete lining, shafts and tunnel	199,000	"
Cement, concrete bulkheads	16,160	"
Cement, concrete pipe foundations	4,590	"
Cement, total in concrete	226,620	"
Cement, grouted in shaft lining	1,200	"
Cement, grouted in tunnel concrete lining	45,340	"
Cement, grouted in metal lining	14,380	"
Cement, grouted in bulkheads	26,510	"
Cement, grouted in test holes	28,550	"
Cement, grouted in pipe supports	2,000	"
Cement, total in grout	117,980	"
Cement, total in concrete and grout	344,600	"

*Total of 2,000 pounds.

In this undertaking the cost of construction must be classed in two accounts: first, the cost of the shafts and tunnel constructed under normal conditions in the two types of rock formation; and, second, the extraordinary cost and expense of that portion of tunnel, approximately 400 lin. ft., constructed in the decomposed rock formation. The cost of the permanent pipes and interior equipment is an entirely distinct item of expense, bearing no direct relation to the cost of the tunnel.

It is worthy of note that the unit costs, with the exception of the great expense of getting through the decomposed rock, was less than the original estimate.

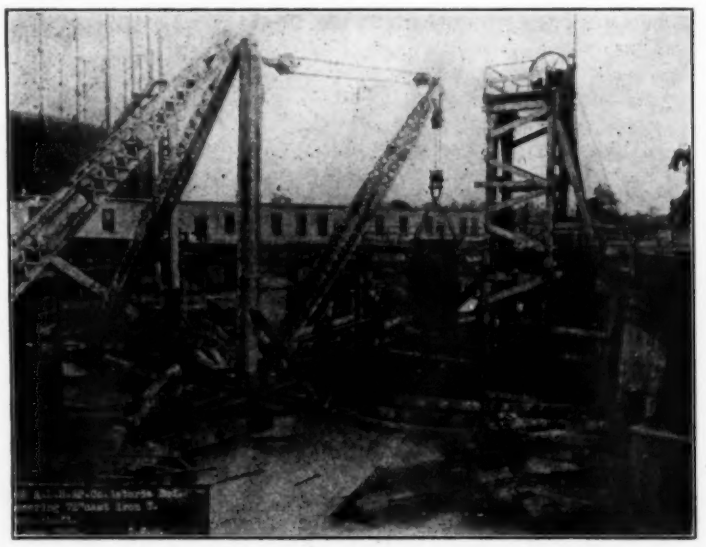

Fig. 9.—Lowering 12-Inch Cast Iron T Down Shaft.

The Cast Iron Gas Pipe.—The cast iron pipe laid in the tunnel is the largest ever made; internal diameter 72", thickness of metal in the pipe walls 2¾", hub and spigot joints, and standard 12 feet lengths. The weight of each length is 26,000 pounds, and the displacement of water by it represents some 24,800 pounds. so that, even should the tunnel fill with water, the pipes would retain their position.

The mains are laid in two parallel lines occupying the lower portion of the tunnel, and supported on concrete bed-blocks. The structural steel runway (Fig. 9), for supporting any future utilities that may be put in, extends through the tunnel just above the mains. The concrete blocks are 6 feet apart, each block supporting both lines of pipe, and the joints of the two lines are staggered. Every second block supports a cast iron column that braces the center of the transverse runway beams, the actual support for the runway being by cast iron brackets anchored to the concrete tunnel walls. In both shafts the two 72" risers are connected to the tunnel lines by double-spigot eccentric reducers and bell-spigot-bell

tees. The spigots and bells in the risers are machined on the face to make true bearing for the vertical pressure loads. At the top of each shaft flanged spigot tees, reducing to 48", connect to 48" pipes through the shaft lining into concrete valve pits, thence passing underground—in Astoria to the gas holders, and in The Bronx to the street mains. Each shaft is equipped with an elevator and an emergeney ladder, the elevator framing also acting as a bracing for the pipe lines. The tunnel runway extends to the elevator landing at the bottom of each shaft, and in the Astoria shaft there is an operating floor in the enlargement.

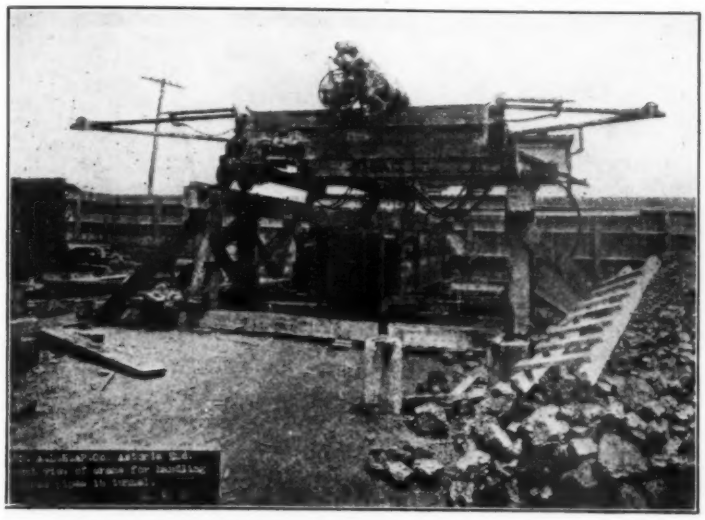

Fig. 10.—Crane for Handling 72-Inch Cast Iron Pipes in Tunnel.

The traveling crane, Fig. 10; for handling and erecting the pipe within the tunnel, was constructed on a wood frame, fitted with cast-steel wheels, running on steel girders attached to the concrete tunnel walls by the brackets previously mentioned. The wheel base of the crane was the same as the bracket spacing, so that the load on the bracket could not exceed the maximum wheel load of the crane, 15,000 pounds. The crane was operated by two 5-horse power air engines—one for the longitudinal and the other for the transverse movement. The speed was from 40 to 50 feet per minute, quite sufficient for the short distance covered. Each end of the crane had two swinging arms, to each of which was attached a cable hoist, operated by an air-driven ram, to lift the crane girders. for the purpose of moving them ahead, section by section, as pipe laying proceeded.

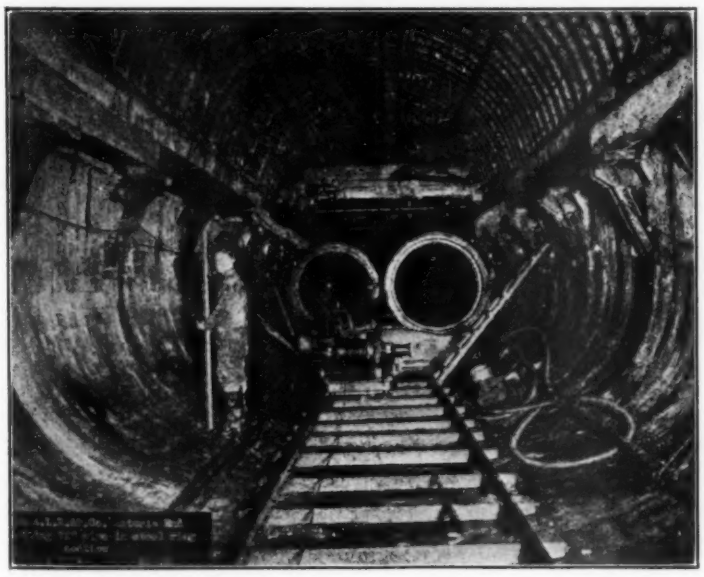

Fig. 11.—Setting 72-Inch Pipe in Steel Ring Section of Tunnel.

The laying of the mains was done by the tunnel construction organization, the jointing by the Department of Mains of the company, and it devolved on the tunnel organization to test the joints after they were caulked. The requirements were that each joint should be tested by air pressure at 20 pounds per square inch, and that such test should be applied as each 10 pipe lengths were laid. It was obvious that the latter requirement would limit the progress of laying to the rapidity of caulking operations, and interfere seriously with procedure. Further, to consider plugging the end of the main with a portable end bulkhead, to be erected and secured as each 10 lengths were laid, would involve great delay, as the caulking operations would have to be completed up to the last length laid before such testing could proceed. The writer, therefors, designed a novel machine (Fig. 12) for testing joints. It was a traveling outfit, consisting of a double bulkhead on a wheeled frame, which could be pushed by hand through the inside of the pipe, and enclosed a joint within an annular space. The two bulkheads consisted of pneumatic tires, inflated, to make a tight joint between the testing machine and the inside wall of the pipe. The machine consisted of a cast iron piston, 71½" in diameter, or ½" less than the internal diameter of the pipes, and 12" long, with exterior flanges, giving an annular space between flanges of 12". The two flanges were designed to cove form, to give close support to a soft and elastic rubber tube, and the exterior rings, attached by bolts to the center casting, like a junk ring to a piston, held the rubber packing rings. These flanged groves were fitted with a continuous tire tube, 2½" external diameter, with ⅜" rubber walls, made of the finest inner tube rubber, and fitted with a standard automobile tire valve. These tube rings were 71" in external diameter, and inflation forced the tire out against the wall of the pipe and filled the grooves of the piston.

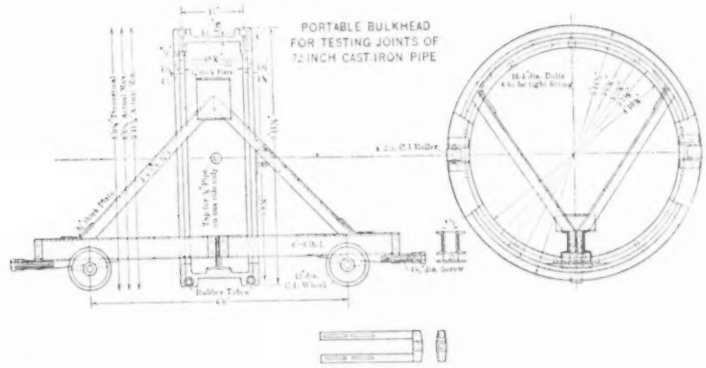

Fig. 12.

As the testing pressure was 20 pounds per square inch, it was thought that the pressure to which the tubes would need to be inflated to make a tight joint might be about 80 pounds, and though this pressure was used at first, it was found that 50 pounds was ample to make a tight joint for testing. In operating the machine, the annular space was set central over the joipt, air from the high-pressure tunnel line was supplied by a flexible hose and reducing valve to the manifold connecting both rubber tubes. These being inflated, the test pressure was applied through another reducing valve, and the lead joints tested with soap solution. The machine was easily operated on its roller frame, joints cauked at any point could readily be tested, and, if re-caulked, readily re-tested.

The methods adopted in laying the 72" pipes in the tunnel consisted of lowering both pipe and saddles down the Astoria shaft, hauling to the Bronx end, and advancing the work toward Astoria. This work was only carried on during an 8-hour day shift, as it was not desired to run any risk in handling this heavy material at night. The pipes were laid in pairs; that is, the operations consisted of the hauling and setting of two saddles, followed by the hauling and setting of two pipes; these followed by two more saddles, etc. By maintaining two saddles ahead of the pipe in place, this scheme permitted an overlapping of the various operations, such as placing and setting saddles, setting pipe, moving crane girders, removing hauling track, etc., thus reducing the loss of time to the minimum.

The pipes, which varied within 1½" of the correct length, were all numbered, and were selected from the storage rows as the work proceeded. Each pipe was transported to the shaft by rolling on skids by a single cable engine with the cable looped around it. They were lowered singly down the shaft by the derrick, and with every other pipe two saddles were lowered.

The pipes and saddles were landed directly on flat cars, and haulage to and from the point of work was by the endless cable system on a single track, the pipe cars run at a speed of 6 miles per hour, and the other loads at 10 miles per hour. These speeds were greater than those usually adopted for an endless cable system in tunnel work, but the system was designed with the mini-

(*Continued on page 350*)

THE AMERICAN GAS LIGHT JOURNAL

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SANFORD K. CAMPBELL, Editor.

NEW YORK, MONDAY, OCTOBER 18, 1915.

Talk on Safety.

At the recent meeting of the Michigan Gas Association, a very interesting part was a talk on Safety by C. B. Scott, of the Chicago Bureau of Safety. Mr. Scott urged gas companies to go about safety work in a common sense way rather than make it spectacular. In other words, make accident prevention a part of the business rather than a fad, give it all the dignity possible, and get the co-operation of the employees. He cited numerous examples where safety meetings of employees had been held and encouraged by the management, which resulted in greatly decreasing the accidents.

One street railway concern, whose records showed 47 accidents per month at a cost to the company of $32,000 a year, organized accident prevention meetings among their men, and reduced their accidents to 8 a month at a cost to the company of $5,000 a year.

Mr. Scott showed that among public utilities 15% of the accidents were from some mechanical cause, and 85% of the accidents were caused by thoughtlessness. He pointed out, however, that the 15% of accidents from mechanical causes were usually far more serious than the 85% of thoughtlessness, In the electrical business, for instance, only 8% of their accidents were caused by electric current, but in this 8% were usually numbered their most serious accidents.

Reasonable Basis for Rates.

The Rate Research Committee of the N. E. L. A., after discussion lasting over some years, has come to the conclusion that companies have in the past established rates so as to be able to serve the public; and from time to time revised them to increase the service rendered, and decrease the average cost to the public of such service, by means of more efficient utilization of the investment.

The committee also concluded that, an analysis of the principles used in making rates will be more helpful than efforts to justify rates by theories not based on the principles actually used in the formulation of rate schedules.

The committee believes there are two fundamental principles:

First—That the rates of the company should, as a whole, produce an income sufficient to give a fair return on the investment and attract capital freely to the enterprise. The gross earnings from the sale of the product must, therefore, be sufficient to cover all necessary expenses of operation, including taxes, bad debts, etc., a reserve for renewals and contingencies, interest at current rates, and a reasonable profit in addition.

Second—That when the rates as a whole are giving a fair return on the investment as above described, then the rates to separate individuals and classes that make up the rates as a whole, should be adjusted to make the total cost as low as possible, and the service rendered as great as possible, by means of the most effective utilization of the plant.

The committee has further concluded that these results can best be obtained by adjusting the various rates to the value of the service rendered; giving proper consideration to the relative costs of service, and defining value of service rendered as the amount which the user would have to pay for the same or equivalent service, under absolutely fair but not destructive competition; in other words, the amount for which the user could serve himself, or provide an equivalent or substitute service under fair competition.

Patent Litigation.

Since the promulgation of the new rules of practice of the U. S. Courts of Equity, on November 4th, 1912, sufficient time has now elapsed to show their effect.

Undoubtedly patent litigation has materially decreased, due, it is said, to the unfortunate business conditions that have prevailed for the past 4 years, and in part to the fact that the average patent lawyer was uniformed as to how to prepare the requisite bill of complaint or answer and present his case to the court, in many cases leading lawyers to advise their clients not to proceed with litigation for the time being.

The new rules have greatly reduced the time usually consumed in the examination and cross-examination of expert witnesses in suits presented to the court, effecting considerable saving to litigants and permitting the case to be brought to a conclusion in a much shorter time than was previouly required.

Another effect has been to enable contestants to obtain the opinion of the judge, as derived by him from hearing the examination of the witnesses in court, such an opinion being recognized as apt to be more just and equitable than one derived from reading printed testimony, where the character and the demeanor of the witnesses is unknown to the court. They have also taken patent litigation out of the hands of professed patent lawyers, many of whom have no knowledge of law, except as related to purely patent questions, and put in the hands of general lawyers, i. e., men thoroughly conversant with methods of presenting a case in court, the rules governing evidence, etc. Practice for the last two years has demonstrated that a case in the hands of a competent general lawyer, assisted by an expert familiar with the technical questions involved, and capable of preparing a technical exposition and argument, is better handled than by the old practice of employing a patent lawyer, and leaving him to hire and instruct an expert. Present practice is just the reverse of that heretofore employed. Formerly, the patent lawyer instructed the expert; now the expert instructs the general lawyer on the technical questions involved.

The present rules not only decrease the cost of litigation, but effect more substantial justice. The owner of a good patent, be he poor or rich, can cheaply and readily obtain a judgment. Those having worthless patents, or corporations who use them only for obstructive purposes, find that the old methods of annoying and exhausting a competitor, or destroying the value of a good patent in the hands of a poor man, are no longer possible.

The Best Securities.

Albert W. Atwood, in McClure's for October has an article on "War-Proof Bonds" devoted to a discussion of the merits of public utility securities. "Literally there is probably no such thing as an absolutely war-proof bond, or investment of any description," says Mr. Atwood. "Who knows what the ultimate economic results of the great war may prove to be? But the title of this article was written with a particular class of securities in mind, 'public utilities,' which may fairly be said to have escaped thus far. They have not benefitted from the war like the shares of companies which manufacture munitions, but neither have they suffered. Certainly no other class of securities, unless perhaps real estate mortgages, have been affected so little by the war as the bonds of companies supplying gas and electric light, power and traction."

ANNUAL MEETING, EMPIRE STATE GAS AND ELECTRIC ASSOCIATION.

The Eleventh Annual Meeting of the Empire State Gas and Electric Association was held in the United Engineering Societies Building, on Thursday and Friday, October 7th and 8th. In the absence of the President, who was detained returning from the Gas Institute meeting in California, the first vice-president, Mr. E. H. Palmer, presided at the meeting on Thursday.

The morning session was called to order at 10:30 A.M., and was devoted to reports of officers and committees.

The Secretary read a resume of the work of the Association during the past year, and the Treasurer submitted his report, showing a successful year from a financial standpoint.

On behalf of the Accounting Committee, Mr. E. C. Scobell stated that the Committee had been in conference with the Statistician of the Public Service Commission, Second District, in reference to certain modifications in the accounting order of the Commission. He read a number of suggestions, which are being considered, and expressed the belief that changes would be made in the order which would be found by the companies to be of benefit in their accounting methods.

Mr. C. C. Durfee, Chairman of the Electric Meter Committee, read a report describing new types of electric meters, which had been placed on the market. In discussing his paper, it was brought out that the electric companies are in a better position at the present time than ever before in reference to more scientific methods of rates, on account of improvements in the meter devices which have been effected largely through the efforts of the meter committees of the various associations.

At 12:45 the meeting adjourned for luncheon, which was served in the building.

The afternoon session started at 2:30, with an address by Mr. E. W. Lloyd, President of the National Electric Light Association, on "Co-operation between State and National Associations." Mr. Lloyd called attention to many of the activities of the National association, and the importance of them to individual companies in the different States. Mr. H. B. McLean, President of the National Commercial Gas Association, followed Mr. Lloyd on the same subject, and on behalf of his Association, stated that they were very much in favor of some scheme of co-operation.

The Secretary explained that he had asked Mr. Ramsdell, the Secretary of the American Gas Institute, to invite whoever might be elected President at the meeting in California, but had not heard anything from him. Mr Addicks, past-president of the Institute, although not speaking officially, expressed himself as very strongly in favor of some method of co-operation between the various organizations, to avoid duplication of effort. There was considerable discussion on this question and both Mr. Lloyd and Mr. McLean stated that they would take the matter up with their directors at the earliest possible date.

The morning session, on the 8th, was called to order at 10:30 by Mr. DeLong, who had arrived the night before from California.

Mr. C. A. Graves read a paper on "Method of Analyzing Cost of Service," submitting forms applicable for use in this connection for both gas and electric companies. The discussion, following the reading of the paper, dealt mostly with electric matters, the gas companies having apparently done comparatively little in the matter of detailed analysis of costs, on the basis of demand customer and consumption cost, suggested by Mr. Graves.

Luncheon was served to the members at 1 o'clock, in the Engineers' Club, after which the meeting reconvened and listened to a paper by Mr. J. T. Hutchings, on "Insurance Under the New York Workmen's Compensation Law." Mr. Hutchings stated, among other things, that he felt that the risk of the gas and electric busines had been very much overrated. The record of the Utilities Mutual Insurance Co., composed entirely of gas and electric companies, showed losses amounting to only slightly over 16% of the premium. The statistics, which have been kept, giving the figures for the different branches of the business, were read by Mr. Hutchings and were apparently of very considerable interest to the members.

The Nominating Committee submitted its report and the following officers were regularly elected:

President, J. C. DeLong.
First Vice-President, Stuart Wilder.
Second Vice-President, H. M. Beugler.
Treasurer, C. A. Graves.
Secretary, C. H. B. Chapin.

INSTITUTE DIRECTOR'S MEETING.

The September meeting of the Board of Directors, American Gas Institute, was held at the office of the First Vice-President, and was called to order by him at 10:20 A.M., in the absence of the President.

The following were present: Messrs. R. W. Bush, A. E. Forstall, Walton Forstall, W. H. Gartley, C. H. Graf, J. B. Klumpp and Geo. G. Ramsdell.

The Public Relations Committee submitted its annual report; there was no report from the Technical Committee.

The Board authorized the execution by the President and the Secretary, on behalf of the Institute, of the affiliation agreements prepared by the Institute and already executed by the New Jersey State Gas Association, Pennsylvania Gas Association and the Illinois Gas Association. This action formally adds the New Jersey State Gas Association to the list of affiliated associations.

The Board received an informal financial report from the Treasurer, which showed that notwithstanding the greatly increased expenses of this year, caused by the size of the Proceedings, the final deficit was not large. This result is due to the splendid work of the Finance Committee, who reported that they had received to date, $4,360 as a result of their appeal to various gas companies to meet the Institute's deficit. The Committee was thanked for their effort.

The Secretary reported that all the names on the September ballot had been unanimously elected.

Some resignations were accepted and certain names stricken from the rolls for non-payment of dues.

ILLUMINATING ENGINEERING SOCIETY, ANNUAL MEETING AND NEW YORK SECTION MEETING.

The officers of the Illuminating Engineering Society for 1915 and 1916 were elected by ballot some months ago, but were officially installed on Tuesday evening, October 14th, at the Engineering Society's Building, prior to the election meeting of the New York Section. Retiring President McAllister, in summing up the year's activities, stated that the membership totals 1,300; the transactions required 1015 pages and the sum of $383.00 represented the deficit.

President-elect C. P. Steinmetz said that others outside of those connected with the central station and manufacturing end must be interested, if the society fulfil its functions. He also advocated another course of lectures similar to those given at Johns Hopkins.

The New York Section meeting was devoted to the subject of Lighting in War. Lieut. C. S. McDowell, of the Brooklyn Navy Yard, covered the subject from the standpoint of the Navy, and Capt. E. Ardery, Corps of Engineers, U. S. Army, described various applications in relation to land operations.

The papers were discussed by Messrs. Auerbacher, Sperry, Minnick, Steinmetz, Macbeth, Luckiesh and Porter.

The attendance of over 100 was all that could be desired, and it is to be hoped that Chairman D. M. Moore will continue to have the same success throughout the season. As Sec'y Norman D. McDonald has had a year's experience as chairman of the paper committee, there is good reason to believe that this wish will be fulfilled. The usual dinner, at Keene's, preceeding the meeting, was well attended.

(*Continued from page 247.*)

The Astoria Tunnel under the East River for Gas Distribution in New York City.

mum number of sheaves and turns possible, so that these speeds were readily maintained and without accident.

On the arrival of the saddles at the point of work they were transferred from the flat cars to the tunnel invert by the crane and accurately set to alignment, grade being maintained by steel wedging beneath them. The pipes were taken from the flat cars to position by the crane, two 1" wire cable slings attached to a 10-ton chain block being used for raising the loads.

The setting of the pipes was followed, some 200 feet back, by the caulking, and this, at a like distance, by the testing machines; so that there was no confusion between the various gangs.

The joints were caulked with small air-driven caulking hammers, hemp yarn and lead wool being well driven to a depth of 5½" into the caulking space, which was ⅝" wide. This required 4 pounds of soaped yarn, 10 pounds of dry yarn, and 225 pounds of lead per joint, the latter including 2% waste. The average process was 16 joints caulked each day with 16 hammers. After testing, the joints were thickly coated with red lead.

Excellent progress was attained in laying the tunnel pipe, especially considering the fact that the entire tunnel transportation in both directions was over a single track. An average daily progress of 12 pipe lengths was attained for the whole work, and in the half tunnel length last executed the average progress was as great as 16 lengths per day. The erection of the structural steel runway proceeded from the Bronx end toward the Astoria shaft, the material being lowered down the Bronx shaft. No difficulty was found in doing this work at the same rate as pipe laying, and it was not featured by any incident of unusual interest.

Personnel.—The undertaking herein described was carried out for the Astoria Light, Heat and Power Company (an organization closely affiliated with the Consolidated Gas Company of New York), and was under the general supervision and direction of Mr. Wm. H. Bradley, Chief Engineer, and William Cullen Morris, Engineer of Construction. Mr. Colin C. Simpson, Superintendent of Mains, had direct charge of jointing the pipes inside the tunnel, and of laying the street mains connecting therewith.

The development of the plan for the project of building the Astoria Gas Plant and the Astoria Tunnel herein described, must be attributed directly to Mr. Bradley.

The design, engineering, and construction of the work were executed by Jacobs and Davies, Incorporated, as Tunnel Engineers, for whom the writer acted as Engineer-in-Charge. The field engineering, including surveying, alignment, and detailed field work in connection with the construction, was first in charge of Mr. G. F. Weismann, and during the latter period was in charge of Mr. J. Chadwick Scott, who had previously acted as Assistant Field Engineer. The construction work, throughout, was in charge of Mr. Vivian Messiter, as Engineers' Agent, assisted by Mr. Alexander W. Hodgson, as Mechanical Engineer.

Domestic Lighting.

Paper by J. D. SHATTUCK, to the International Gas Congress.

The subject of domestic lighting and its relation to the gas industry is one of the most interesting as well as one of the most important problems that confront the gas industry to-day. It is the portion of the business that reaches the greatest number of gas consumers. Further than this it represents a large proportion of the gas sold in the United States; and this fact alone would stamp it as worthy of the most searching study.

Competition is the life of every successful business. It is the underlying secret of the present state of our country's prosperity, but success in competition is a survival of the fittest, as represented by initiative and originality. The gas industry has the competition; but have all departments of the industry always had the initiative and originality that would keep them in the forefront of public interest? Did we not for a short period, fail to realize the importance of the domestic lighting branch of the business, by failing to give it the scientific consideration it deserved? At the time when this field of our activity was first broken into by the electric interests, did we not forget our lighting business, and begin to think it was threatened with ultimate ruin, and forthwith turn an undue amount of energy into the industrial fuel business at the expense of our lighting business, thinking that the only course to save our gas sales? We developed industrial fuel experts, and left the illuminating problems to the plumbers and fixture men who had no interest except the amount of profit they might realize on any gas work they obtained. Their interests at that time were in no sense our interests. Our competitors launched out at this critical moment with new ideas in illumination, with scientifically designed fixtures and installations. They gave up the rule of thumb methods in vogue, and substituted definite calculation that produced definite results. The development of the incandescent mantle light was their incentive to increased and vigorous investigation to produce a worthy weapon of competition. It was the progress and daring exhibited by them that attracted the interest of the country. This interest developed into belief in the teaching and adoption of the ideas and systems advanced. Now we believe the same results can be accomplished by the gas industry, and this brings me to the purpose of this paper. It is not to predict that we will lose our lighting business, but it is an appeal to the gas fraternity to realize the importance of not only holding our present domestic lighting business, but to go out with progressive and scientific ideas backed by determination to gain additional domestic lighting. We have the means at hand if only we will apply them in the proper manner.

Examination of records will show that customers' lighting bills remain nearly constant. Hard times will cause a decrease in the gas used for fuel, but the lighting business will always hold steady. It represents the most stable department of our business. It is, therefore, the department that demands and deserves a great amount of concentrated effort. It is difficult to accurately state the quantity of gas consumed for illuminating and fuel purposes, from year to year. Any statistics on the subject can be no more accurate than the application of an average of a small portion to the entire business, because a very small portion of the gas used for fuel purposes is separately metered. The total gas metered must be more or less arbitrarily divided on the basis of the average of a small portion definitely investigated. The following statistics from the latest report of the Geological Survey represent the most authentic figures on this question.

The total quantity of artificial gas sold or utilized in 1908, was 156,909,310,000 cubic feet; in 1912 this figure had increased to 212,391,168,000 cubic feet. But while the total volume increased, the actual sales for illumination decreased, the increase being due entirely to gas utilized for fuel purposes. The proportions of total for illumination and fuel purposes are as follows:

	Gas sold in M cubic feet for		
	Illuminating	Fuel	Total
1908	109,290,117	47,619,193	156,909,310
1912	100,000,321	112,390,847	212,391,168
	Percentage of artificial gas sold for		
	Illumination	Fuel	Total
1908	69.65	30.35	100.00
1912	47.08	52.92	100.00

This table shows that the percentage ratio of artificial gas used for illuminating purposes decreased 22.57% from 1908 to 1912; that the actual consumption for illuminating purposes fell off 9,289,796,000 cubic feet.

The comment in "Geological Survey Bulletin" on these figures is as follows:

"This decrease in the consumption of illuminating gas is due in part to the more extended use of gas saving devices, such as the Welsbach burner, and in part to the increased use of electric light, the latter probably predominating."

The figures for natural gas have been omitted, because the information on natural gas is not available in the same form. However, the natural gas used for domestic purposes and industrial purposes is as follows:

	Quantity in M. cubic feet		
	Domestic	Industrial	Total
1908	140,583,732	261,556,998	402,140,730
1912	193,454,802	368,748,650	562,203,452

While this table shows an increase in the amount of natural gas for domestic use, it does not mean that any of this increase was for illuminating. It is probable that the increase represents added use as fuel, and probably also covers a decrease in the consumption for illumination. The same general ratio of decrease for illuminating use would probably hold in natural gas figures.

The first step to take in the efforts to advance the domestic lighting business, is to insure good service from present lighting equipment. This refers to all types of equipment, even including the oldest open flame burners. The electric man will tell you his en-

tering wedge for new lighting business is through the old open flame gas burner. It is competition between the most ancient and the most modern. We have the opportunity to replace the open flame burners, and thereby keep him out of the field. Make him compete with the mantle light, which is the modern light.

A systematic inspection of every customer's premises would undoubtedly show a great number of burners out of use due to poor condition. The poor service attendant upon poor installations may not always be the fault of the company, but it is its duty to remedy the conditions, if at all possible. The consumer will not make repeated requests for burner maintenance, with the result that decreased efficiency gives him poor light. He is then open to receive a proposition on electric lighting. A careful study of the faulty installations and equipments, would probably show that unduly large proportions of an installation were being used where one properly regulated should suffice. This places the means of illumination in the expensive luxury class, and results in curtailment of its use and possible change to some different lighting agent. A dissatisfied consumer is easily persuaded to change from gas to electricity, on the promise of better service at reduced cost. Once this change is made, the consumer probably never will be regained, on account of the cost of changing back, even though the competitor's promise may not have been fulfilled. A great proportion of the burners on our lines to-day are of the open flame type, and likely to remain so for some time. So we should first guarantee good service with the open flame burner, and endeavor to see that the consumer has the best of its kind.

With the gas engineer clamoring for the adoption of the heating value standard, it is very necessary to replace the open flame burners with the incandescent mantle burner. This should be done even where the candle power standard is still in use, for where the illuminating value is good the heating value usually is sufficiently high to give the mantle burner decided advantage. The mantle burner at once insures higher efficiency and better illumination, and better illumination means increased hourly use of the burner, with very little, if any, decrease in the total consumption of gas in a year's time. The consumer is receiving good service for the money expended, and is satisfied to pay the bill.

For argument, suppose in a number of installations we cut the consumption in half by the installation of mantle burners, and give the consumer more light. It is an evidence to the consumer of the increased efficiency of the later developments in gas lighting equipment. Is not that a point in our favor when we later talked to him about fuel appliances? You have helped him once, and he will give you opportunity to make up the loss by using gas in some other appliance. Very soon he is consuming more gas than ever, but is getting better results and service, and is satisfied. We must not feel that we have accomplished our purpose when we have the order to change the installation to mantle burners. This point marks the beginning of the application of some scientific knowledge. While we may have succeeded in giving the consumer the greatest quantity of light for a dollar, we must apply accurate knowledge to give him the light in the most usable and advantageous way. The item of service must be balanced with the cost to produce the results that the consumer is desirous of having. We must insure better lighting to the consumer, and better lighting may mean better and more attractive fixtures, just as well as more efficient production of light.

Many people have the opinion that gas lighting is inartistic. We have not educated the public sufficiently in knowledge of the advances made in gas lighting. In the June, 1915, issue of a small magazine published by one of the country's largest fixture manufacturers, the following statement appears on the editorial page:

"Prospective buyers of chandeliers may be divided roughly into two classes: (1) builders of new buildings and (2) owners of buildings not wired for electricity, or wired but not equipped with chandeliers of modern design."

This manufacturer includes gas fixtures in his product but seems to forget about them when it comes to advertising. Is it because the gas interests have not helped him create a demand for the artistic effects in gas lighting? The public must be apprised of what can be supplied for artistic and appropriate effects. We must match up our lighting fixtures with the other furnishings in the room, then place the fixtures where they will produce the best results. With this accomplished, the first advance has been made toward ensuring the use of gas for lighting.

Following up this advantage, must come a broad maintenance service. I say a broad service in contrast with the average domestic maintenance service, which is very limited in its scope. This should first be a systematized maintenance service, handled by capable men with a thorough knowledge of burners, their trouble and the remedy for the troubles. In the installation and operation of domestic maintenance we will find it necessary to convince a great many of our consumer, of our real interest in good service to them. A great many will look on our efforts with suspicion. But the continuation of a systematized service will undoubtedly justify its existence. The development period will undoubtedly show a money loss, but this is true of most any business undertaking. It is also true that the business that enters the field to supply a necessity will soon overcome its development losses and pay dividends. While maintenance service may not reach the dividend basis, I am firmly convinced that if properly organized, and systematically operated with a definite purpose in view, it can be counted on to produce a return equivalent to or greater than the return on the same amount of money spent in advertising the subject and asking consumers to "tell us if their lights are not in condition." Spend the equivalent money in going out to find these spots of unsatisfactory lighting service, and remedy the defects. It is advertising of the direct type which will produce a dollar's worth of return for every dollar expended. In our various gas appliance compaigns we do a certain amount of advertising, and then follow up with personal calls. The calls are the business producers, and if they produce business in appliance campaigns they certainly should produce returns in a lighting campaign.

To produce the best lighting results we must get in touch with the burner. A broad maintenance service properly operated will get us there. The burner, in turn, will get us in direct touch with the consumer. I will not attempt to outline the details of maintenance service; but I express the hope that this coming year will find each gas company deep in the domestic maintenance service, on broad lines; not necessarily operated on the same plan as a neighboring company, but on a plan suited to its own needs and a system that will accomplish the most good for its particular requirements.

There are means at hand to produce the most artistic, as well as convenient, lighting installations, with gas. We find specially designed burners adapted to fit most every decorative scheme of house lighting. As gas companies create a greater demand for decorative lighting units, we will find the manufacturers producing a broader and more complete line to meet the demand. One good field to be given the attention of the gas salesman is that of changing over old oil lamps to gas lamps. A great many good domestic customers still cling to their oil table lamp, which savors of an heirloom, and consequently is not disposed of for an up-to-date artistic gas lamp. I am confident, however, if we will let it be known that such lamps can be changed to gas without in any way changing its external appearance, that the consumer will welcome the opportunity, and have the change made. The table lamp comes in for a lot of use, and is a good gas consumer. Undoubtedly all the up-to-date gas men are familiar with the various types of combination fixtures, both direct and indirect, as well as the inverted semi-indirect fixtures now on the market. There is a very complete line of adaptations, which will be broadened as soon as we create the demand.

The burners may be lighted in a number of ways. The most widely used system is the pilot light. In its various adaptations it is applicable to a great many types of installations. Spark lighting is also extensively used and, if installed with due care, proves very satisfactory. The only objection that might be voiced against it can be overcome by properly installed work. The pneumatic valve and mercury valve are applicable to a great variety of installations, and are giving decided satisfaction. The catalytic lighter, as at present developed, offers possibilities of extended use.

In the applications of these principles or devices, we must proceed on some definite basis. A certain amount of expert knowledge is necessary, and a great deal more is desirable. The lighting expert is now qualified to determine the exact number of cubic feet of gas to burn under certain conditions to produce definite desired results, whether it be for definite illuminating results, or harmonize with surroundings. Here knowledge of exact consumption is necessary to meet the cost competition of other forms of illumination.

Good lighting is a necessity in every home, and necessity always finds a market. Any deficiency from what might be a standard or normal amount of good lighting, is due mainly to the failure of the consumer to appreciate the service we are able to give, or what may be broader, to know the service available for his needs. With that in mind, let us go out with the determination to improve every lighting installation. This improvement will keep us in the lead in the artificial lighting business. It will reduce our worries and increase our sales. The American people to-day desire results. We can give them.

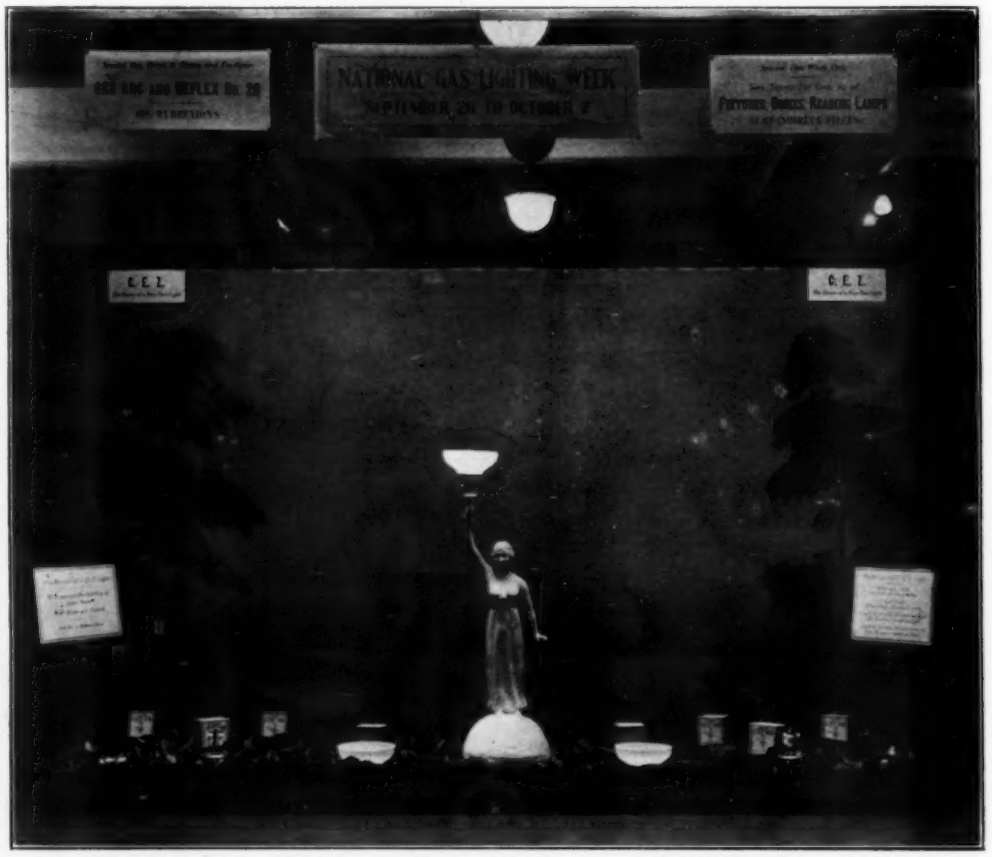
Lighting Week—A Successful Gas Show—Jersey City, N. J.

By H. Thurston Owens.

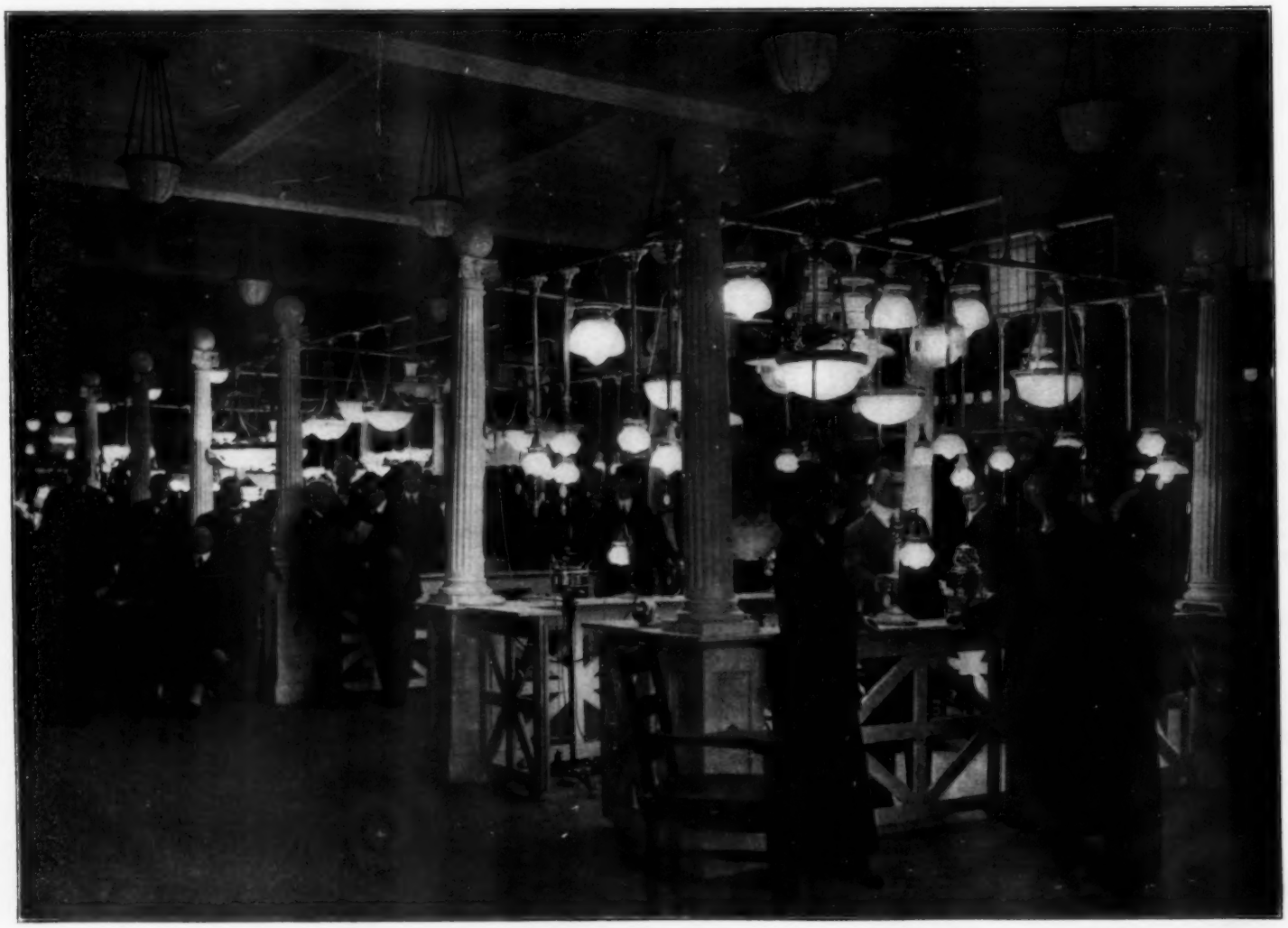
Lighting Week was more than a mere sales effort at Jersey City, N. J., as it proved to be a successful gas appliance show with an attendance of nearly 8,000 people.

The Jersey City office of the Public Service Gas Co., is headquarters of the Hudson Division, which includes Jersey City, Hoboken, West Hoboken and Bayonne. In planning the Exhibit, Division Agent F.W. Schmidt and Local Agent E. G. Kent, appointed a committee of arrangements consisting of G. E. Smith, Chairman, E. Jacobson and C. J. Van Winkle, who immediately called upon representatives of the lighting manufacturers for advice and assistance.

The final plan consisted of three booths, down the center as shown in the accompanying cut, where the latest products of the General Gas Light Company, Welsbach Company, and Bayley & Sons, were exhibited. With lighting as the main exhibit, it became evident, as the plans developed, that this would prove of sufficient interest to insure a large attendance, and is was decided therefore to group around the handsome lighting display, other appliances, especially suitable at this season of the year. These exhibits were made by the following firms: W. M. Crane & Co., Rathborne, Sard & Co., J. B. Slattery & Bros., Manhattan Heating Co., J. B. Clow & Sons, Reliable Stove Co., Sanitary Heat-



The charm of this window lies in its simplicity.



These booths were more than lamp racks and burner bars. The latest developments in Gas Lighting were demonstrated and sold.

ing Co., E. H. Mead & Co., Reznor Manufacturing Co., Gillinder & Sons, Royal Art Glass Co., Davey Garage Co., C. H. Cumberland, Adams Bros. Manufacturing Co., and Consolidated Lamp & Glass Co.

Successful merchandizing requires interesting people enough to have them visit your salesrooms, having your windows attractive and the display of goods timely and well arranged. All three of these were accomplished at Jersey City. The several windows were dressed in a very creditable manner, and although the one reproduced herewith would no doubt be a prize winner in a competition, it did not far outdistance the others.

The gas show was open to visitors from 1 to 5 P.M. and from 7 to 9 P.M. each day, and as the attendance at the end of the first week was found to be over 4,000, and it was decided to continue the exhibit for another week.

The gas office is often looked upon as a place for kicking, instead of carnivals and cabarets, but every one who had the good fortune to attend the show were most hospitably received, and their better nature brought out by music, and their contentment assured by means of waffels, griddle cakes and coffee.

There are two very important features in all gas shows; one is that you must make sales, and the other being the compulsory education of the gas company employees. The sales at this exhibit amounted to some $2,000 of gas lighting equipment alone, and the "prospects" for future business included the Mayor of the city, Judges and other prominent residents.

The evening devoted to the plumbers proved to be the banner one for both attendance and sales, so that it may be said that the sales feature was a success.

As far as the employees of the company were concerned, instructions were given to each of the 62 salesmen in Hudson County to visit the exhibit at least once.

Invitations sent to all gas companies in this part of the country were liberally accepted, and it may be said that the educational side was successful also.

Of all the appliances exhibited very few remained unsold at the end of the display, and these were all purchased by the company.

Plating by Impact.

The Schoop process of plating by means of a metal spray is now well known and in commercial use. A process of the same type is in course of development by C. F. Jenkins, of Washington, D. C.

This process can best be understood if it is remembered that when an electric lamp bulb gives way a discoloration of the inside of the bulb occurs; and when a fuse plug "blows" the mica cover is discolored. This color is black when the fuse is of lead, but it is a reddish color when a piece of copper wire is used. This would seem to indicate some kind of deposit resulting from the blowing of the fuse, that it is not completely volatilized. Under a magnification of 300 diameters or more, minute particles of copper are discovered adhering to the cover of the fuse plug, and, when a common visiting card is used for a cover instead of the mica, a decided deposit is attained. Repeated charges of such a fuse result in a complete coating of the card, and when the surface is burnished with some smooth hard object, a shiny polished metal surface results. A fuse used in this manner is, in effect, a gun that throws a shower of miniature shot so small as to be invisable; and this would operate successfully for covering almost any surface but for the annoyance of the frequent replacements with short pieces of copper wire. This led to the development of a special "gun" into the barrel of which a copper wire is continuously fed. A pair of small rollers actuated by a motor pulls the wire off the supply spool, and projects it across the barrel until the end touches the opposite surface. The inner lining of the barrel and the propelling rollers form a short circuit, the wire is immediately melted, and the heat causes it to be thrown out of the barrel against the object held in position for that purpose. When a plurality of wires or a flat ribbon is used in order to cover a larger area in a given time, it is found desirable to add a propelling force, and this is done by introducing into the barrel behind the wire a small charge of explosive gas. The melting of the wire explodes the charge, which projects the miniature metallic particles that are momentarily suspended in the gas against the object to be coated. Objects in great variety can be coated in this way, and any electrically conductive material can be used for the purpose.

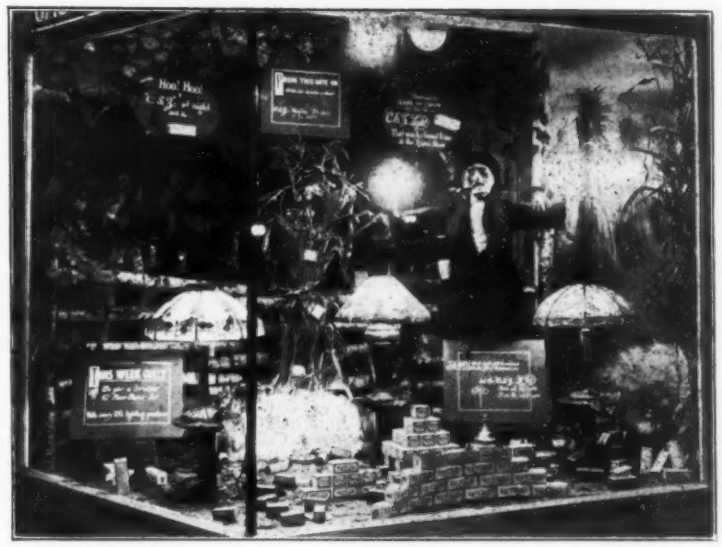
Lighting Week at Hazelton, Pa.

By J. H. Gaylord.

Harvest time was the keynote which we endeavored to strike in our Lighting Week Window and Display. The former is shown in the accompanying illustration, and the signs which we used received very favorable comment. Some of them read as follows:

From the Owl's bill we ran a ribbon to a sign, which read:

HOO HOO
I
SEE EASY AT NIGHT
WITH THE C.E-Z. LIGHT.



Harvest Time at Hazelton.

In the opposite corner the scare crow holds a C.E-Z. lamp in each hand, and the sign reads:

I DON'T WANT TO SCARE NOR CROW,
BUT THAT OWL USES THE C.E-Z. LIGHT
THAT WON THE GRAND PRIZE AT THE FRISCO SHOW.

It gives me pleasure to say that we were greatly aided by the cooperation of other gas companies' advertising during Lighting Week, and that I feel that the results will surpass Gas Range Week.

We have noticed a remarkable change in our consumers in the last two years largely due to national publicity which should go on, doubly strong.

Recent Patent Issues.

Prepared for the American Gas Light Journal by Royal E. Burnham, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,148,903. Gas Burner. I. M. Justice, Dayton, O., assignor to The Manufacturers' Equipment Co., same place.

1,149,026. Valve Mechanism for Gas Retorts. H. A. Carpenter, Sewickley, Pa., assignor to Riter-Conley Mfg. Co., Pittsburgh, Pa.

1,149,056. Gas Producer for Furnaces W. O. Houston, Bellaire, O.

1,149,257. Portable Gas Cooking Device. M. J. Green, Rockford, Ills., assignor to Eclipse Gas Stove Co., same place.

1,149,334. Gas Heater. G. A. Bonder, Brooklyn, N. Y.

1,149,535. Gas Burner. C. A. Peterson, Washington, D. C., assignor to Welsbach Light Co., Gloucester City, N. J.

1,149,611. Gas Producer. W. O. Amsler, Pittsburgh, Pa.

1,149,622. Gas Burner. G. D. Bradshaw, Westmont borough, Pa.

1,149,631. Machine for Charging and Discharging Gas Retorts. H. A. Carpenter and R. L. Hibbard, Sewickley, Pa., assignors to Riter-Conley Mfg. Co., Pittsburgh, Pa.

1;149,686. Gas Burner. A. J. Reedy, Battle Creek, Mich., assignor to A-B Stove Co., same place.

1,149,716. Gas Meter. J. W. Britton, London, England, assignor to The Gas Meter Company, Limited, same place.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Consolidated Gas, Electric Light and Power Company of Baltimore, report that they sold during the last fiscal year, gas consuming appliances and accessories amounting to $422,131.30. Some commercial activity that, for a bad year.

EMERSON MCMILLAN, Chairman of the Board of the American Light and Traction Company, New York, has also been elected Chairman of the Executive Committee of the company, to succeed the late Gen. Thomas Hubbard. Frank Sullivan Smith has been elected a member of the Executive Committee in Gen. Hubbard's place.

THE Louisville (Ky.) Gas and Electric Company, has agreed to the principal terms of a steam heating franchise that will authorize the company to lay and operate steam heating mains for a period of 20 years, the city to receive 5% of the gross earnings. The Louisville "Post" says: "The Mayor believes that the perfection of the arrangements will mean one of the biggest gains for Louisville in many years, and will go far toward eliminating the smoke nuisance, and will, at the same time, lessen the cost of fuel in Louisville. After the ordinance goes into effect, a systematic campaign will be made, by the city officers, assisted by various civic bodies, against the smoke nuisance, this being a subject in which Mayor Buschemeyer is much interested." The company already does a small steam heating business in several limited districts.

STATISTICS collected by the Central Gas Publicity Bureau of Berlin show that the production of gas by 862 German gas works in the month of June last, was 2.8% more than in June of last year. This is the first month since the war started in which the production of gas in Germany has been higher than the corresponding month of the previous year.

OWING to unusually warm weather in September, the gas output of the Boston Consolidated Gas Company decreased 5.2%. Decreases have been shown by the company each month since July 1, as follows: September, 5.2%; August, 3.1%; July, 2%. In June there was an increase of 4%.

"A. A. SCHLESINGER, of Milwaukee, Wis., is interested in the Western Coke Company, which will construct the largest coke and gas plant in the United States at St. Paul, Minn. It will cost over $2,000,000." At least that is what the Milwaukee newspapers say.

THE Hamilton, O., City Gas Works lost $1,450.75 in the month of September. The manager's report shows: Ordinary expenses, $7,112.42; extraordinary expenses, $176.91; total expenditures, $7,397.33; total receipts, $5,946.58; deficiency, $1,450.75.

AT the annual meeting of the stockholders of the St. Albans (Vt.) Gas Light Company, the following directors were elected: S. R. Dunbar, of Anderson, Ind., F. H. Mills, of Boston, Oliver Stevens, of Lowell, Mass., Adjt.-Gen. Lee S. Tillotson and George S. Butler, of St. Albans. There was not a quorum present, so the directors' meeting was posponed to Saturday, October 9.

A. W. EVANS has been appointed commercial manager of the Athol (Mass.) Gas and Electric Company, to have charge of that department in Orange, Athol and Gardner. Fred A. Compton of Athol will take his place reading meters and collecting bills in Orange.

COLUMBIA, Mo., must continue paying $2.00 for gas, at least until a decision is reached in the State Supreme Court. The State Commission set the price at $1.50, the Columbia Gas Works appealed to the Circuit Court of Cole County, and that court has allowed an appeal to the Supreme Court. The gas company is depositing the difference between the rates with the Central Missouri Trust Company in Jefferson City, the money to be rebated to the patrons if the commission's decision is finally upheld.

IN the hearing to determine gas rates for Los Angeles, Cal., the gas companies have asked the Commission to fix remunerative rates, according to the B. T. U. value of the gas served. Because of the question of supply of natural gas and the necessity of maintaining an artificial gas plant, the companies say they cannot pledge themselves to serve natural gas entirely, although their aim will be to supply gas of as high a heat value as conditions confronting them permit. They pressed their request for the fixing of rates at a "remunerative" bases, asking for three sets of prices—one for gas of less than 1,000 heat units and not less than 900; one for gas less than 900 and not less than 800, and the third, for gas not less than 800 units. The standard of heat units in the mixture used in Los Angeles, since it became possible to use natural gas has been 800.

THE Lewiston, Me., police recently arrested a man giving the name of William J. Snow, who was selling gas lighters, and claimed to be an agent of the local gas company. He was taken before William R. Stevens of the Lewiston Gas Company, and, after being questioned, was released on promising to leave the city.

WILLIAM L. DOYLE, an employee of the New Haven (Conn.) Gas Light Company, while spending a vacation at Bantam Lake, was the hero of a thrilling rescue. He plunged into the lake and saved William Robbins, of New York, when the latter was seized with a cramp while swimming about 100 yards from the shore. Mr. Doyle dived into the water and swam to Mr. Robbins' assistance without even waiting to take off his clothing. Mr. Robbins was under water when Mr. Doyle reached the spot, and the latter had to dive after him.

THE Sioux City (Ia.) Gas and Electric Company has amended its articles of incorporation so that it may take advantage of a new law which became effective July 4. Under the old law corporations were only allowed to carry an indebtedness equal to two-thirds of the capital stock. Under the new law public utility corporations are allowed to carry an indebtedness equal to twice the amount of their capital stock.

GEORGE LIGHT, for a number of years Superintendent of the Dayton (O.) Gas Company, has been elected General Manager and will enter upon his duties at once. The vacancy in the presidency, caused by the death of Edward W. Hanley, has not been filled, Vice-President Oglesbee continuing for the present to fill the position.

CONTENDING that the Supreme Court erred in upholding an ordinance of the City of Portland, Ore., imposing a 3% tax on the gross receipts of the Portland Gas and Coke Company, the company has filed a petition for a rehearing. Suit was brought by the city to collect the tax from the company, and the court upheld the ordinance, on the theory that the tax was imposed on the company's right to be a corporation, and that it was an occupation tax. The company now contends that this was an error, and assign the following reasons: First, that the court erred in holding that the tax imposed was not a tax on the gross receipts, and that it is so unjust and unequal as to be unconstitutional; second, that it erred in holding that its franchise is not taxed for the benefit of the city under the general tax laws; third, in holding that the tax was an occupation tax; fourth, in deciding that it was not double taxation; and fifth, that the power to tax is a sovereign power of the State, and that this authority in this instance had not been expressly delegated by the State to the city.

AT the annual meeting of the various public service companies controlled by the Massachusetts Lighting Companies, Alfred Clarke, who has for the past 18 years been President of the companies, resigned. His resignation was accepted, as he seeks relief from active work to enjoy a well-earned competency. Mr. Clarke, however, will remain a trustee of the Massachusetts Lighting Companies and a director of all the gas and electric companies of which he was president. Arthur E. Childs, who has been vice-president and a director of the Gas and Electric Improvement Company, retires from these offices and will succeed Mr. Clarke as president of each of the companies. Addis M. Whitney, long identified with the properties, succeeds Mr. Childs as vice-president and director of the Gas and Flectric Improvement Company. In recognition of years of faithful service, three of the leading department heads were admitted to its directorate. These are Roscoe Y. Conklin of Arlington, gas engineer; W. S. Bishop, electrical engineer, and H.

L. Ogden, purchasing agent. The officers of the Gas and Electric Improvement Company are now Guy K. Dustin, president; Addis M. Whitney, vice-president; and C. N. Burnell, secretary and treasurer. These officers and Bowen Tufts, Roscoe Y. Conklin, W. H. Bishop and H. L. Ogden are directors.

AT a meetiug of the stockholders of the Consumers Gas Company, Princeton, Ind., a reorganization was effected. Fred W. Freese, of Fort Wayne, gas engineer and contractor, is now president and general manager of the company. He recently bought holdings of some of the other stockholders, and is said to own three-fourths of the outstanding stock. Other officials elected were: Assistant manager, Harry Firstbrook; secretary and treasurer, Harvey Harmon; directors, Fred W. Freese, Harvey Harmon, Stuart T. Fisher, M. Schwarz, H. E. Wolfe.

FOR the purpose of figuring on gas street lighting systems for Salt Lake City, under the new law which permits the creation of "lighting districts." E. A. Shaw, president, and F. Victor Westermaier, manager of the Welsbach Street Lighting Company of America, inspected the principal thoroughfares of the city and talked with some of the business men who have the creation of "lighting districts" in mind. They were entertained while in the city by John C. D. Clark, general manager of the Utah Gas and Coke Company.

L. C. HUNT, late of Benton Harbor, Mich., has gone to Fort Madison, Ia., to take charge of the new business department of the Fort Madison Gas Company, with the immediate intention of directing the soliciting campaign to be waged on modern gas appliances and extensions of gas lighting to unserved residents of that city. Mr. Hunt had charge of the new business department of the gas company at Benton Harbor and St. Joseph, Mich., and was a great success in the two Michigan cities.

A FRANCHISE was granted by the village of Floral Park, N. Y., to the Public Service Corporation of Long Island. The contract calls for four miles of mains to be laid the first year and four miles the second. The corporation agrees to lay fifty feet of pipe free of charge from the curb line, and will lay mains where there is at least one customer to every hundred and fifty feet. The price of gas is to be $1.50, with 15 cents discount, if paid within ten days. This $1.35 net applies to the first five thousand feet used in one month; on each additional thousand feet up to twelve, a reduction of 5 cents will be made, bringing the twelfth thousand down to $1.00 net.

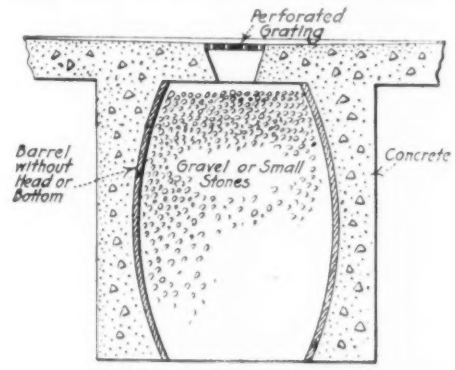
IT will be of interest to our readers to know that the new factory which the Brown Instrument Company occupied a year ago, has proven too small for their growing business, and they have just let a contract for an addition which will furnish 50% additional floor space. The factory, which a year ago, seemed sufficiently large, has been outgrown, due to the large demand for Brown Pyrometers for control of high temperatures.

WORD has been received to the effect that the Village of Fredonia, N. Y., lost in its injunction suit against the old Fredonia Natural Gas Light Company in the appellate division at Brooklyn. This is the action started a couple of years ago to restrain the gas company from laying mains in certain Fredonia streets under a franchise granted to the gas company in the early sixties, and which the village alleges is obsolete. The village obtained a restraining order from Supreme Court Justice Pound. The matter later was tried in Supreme Court on its merits, and the order of injunction was vacated. It then was taken to the appellate court. As it was a case in which Justice Woodward did not care to sit, and there being the possibility of another equal division in opinion, the matter was again shifted, this time to the appellate division in Brooklyn, resulting in a victory for the gas company. Whether the gas company now will be allowed to go ahead with the completion of the laying of the mains started two years ago, or whether the case will go to the court of appeals is not yet determined.

THE Laclede Gas Light Company, St. Louis, has decided to continue its display of all kinds of lighting appliances for another week, for the benefit of the large crowds who will be in the city during the fall festivities. Announcement said the company had decided upon this plan to permit those who were unable to visit their display rooms at Eleventh and Olive streets to see the display.

New Methods and Appliances.

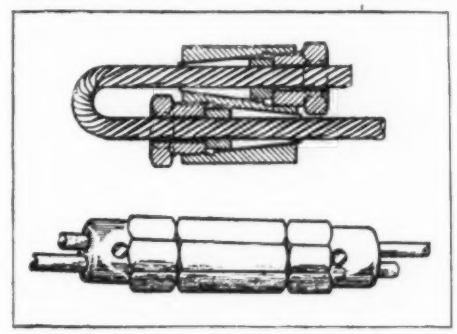
DRAINS FOR MANHOLES.—It is always advisable to connect manholes with sewers whenever possible, so that any water in the manhole will run off at once. Where this is impossible, however, the following method of drainage was suggested in the report of the committee on underground construction at the recent meeting of the National Electric Light Association in San Francisco:



Drainage Pit for a Manhole.

Whenever excavating for the manhole, a pit should be dug at the bottom somewhat deeper and larger than an ordinary flour barrel. In this pit a flour barrel without a top or bottom should be placed, and the space between the staves and the surrounding earth filled with concrete. This concrete should be at least 3" thick. The barrel should be filled with gravel or small stones. The concrete foundation for the manhole may then be laid, so that the top of the barrel comes flush with the bottom of the manhole, and may be covered by a suitable grate.

GRIPS FOR CABLES AND WIRES.—New devices for gripping and connecting cables and wires are shown in the accompanying cut. One is for steel cable, as, for example, in elevator work or in guy lines of various kinds. It is composed of a sleeve with an inside conical surface, and a cone fitting over the cable and slit, so that as it is pushed against the conical surface of the sleeve the segments of the cone are pressed against the cable. It employs the principal of the wedge, and the more the inner conical member is forced into the sleeve, the tighter is the pressure on the cable. A nut is used to drive in the cone, as shown, and the harder the pull on the cable the tighter does the cone press against the cable.



A Wire Gripping and a Wire Splicing Device.

The second is one form of a device for connecting two wires, and this, as well as the cable grip, may be made of steel or brass, according to the circumstances of use, as for electrical wires or steel tension wires, etc. In the straight connection for joining two wires there are two holes extending through the device. Each of the nuts shown toward the end of the device are then screwed in toward the central member, and in so doing the wires are twisted about each other, so that it is impossible to untwist the wires by direct pull, and a close contact is made between the wires, a fact of importance when the connection piece is used in an electrical line.

MONEL METAL MYSTERY.—The curious action of sea water and steel has caused the junking of a half-a-million-dollar pleasure yacht. Within a month or two much has been written concerning the auxiliary yacht "Sea Call," that has had just six weeks of life and has had to be broken up to prevent sinking. The plating was fastened to the steel frames without the interposition of zinc, as is said to be the practice in the navy, and owing to the violent electrolytic action the ship is crumbling apart,

Financial Notes.

ALTHOUGH subscriptions to the STANDARD GAS AND ELECTRIC COMPANY'S $3,750,000 20-year 6% gold note issue do not close until Oct. 15, response has already been received from many stockholders, who realize that the success of the present financing will restore cash dividends on the preferred stock much sooner than would otherwise be possible.

THE boards of directors of the following BYLLESBY UTILITY COMPANIES have declared the customary quarterly dividends of 1¾% on the preferred stock for the quarter ended September 30th, payable October 15th: Northern States Power Company, Western States Gas and Electric Company, Ottumwa Railway and Light Company.

THE officers' report to the stockholders of the CITIZENS GAS COMPANY for the first 6 months in 1915, declares the general industrial depression has affected the gas business. The report says the sales for gas for the first 6 months of this year amounted to 1,106,792,000 cubic feet, as compared with 1,056,387,000 cubic feet for the corresponding period last year. "Since the mileage of mains had increased from 579.51 to 591.66, this increase of only 50,000,000 cubic feet over the sales of the first half of last year, represents a very poor return on the new investment." the report says. "It is not the intention of this report to cause the stockholders of the company to feel discouraged, for although the results of the half year are far below what they would have been under normal business conditions, the outcome of the whole has been such as to encourage the stockholders of the company in the prospects of their business. The strain of the last 12 months has been a severe one, but the company has been able to conduct itself in such a manner as to show fair results, under the circumstances, and to warrant the payment of the semi-annual dividend of 3½%."

THE TWIN STATE GAS AND ELECTRIC COMPANY has placed on the market $720,900 6% convertible gold notes.

THE MASSACHUSETTS LIGHTING COMPANIES annual report says, that during the summer the President of the Trustees made a personal inspection of every gas and electric plant operated by the companies whose stocks are owned by the Massachusetts Lighting Companies. Without a single exception, he found them in excellent physical condition. During the year the trustees purchased 2,000 shares of the North Adams Gas Light Company, at $130; 120 shares of the Clinton Gas Light Company, at par ($500 per share); 1,400 shares of Leominster Electric Light and Power Company, at $100 per share; and 525 shares of the Arlington Gas Light Company, at $100 per share, these securities representing additionial issues which have been approved by the Board of Gas and Electric Light Commissioners of Massachusetts.

THE COLUMBIA GAS AND ELECTRIC SYSTEM reported August gross earnings of $515,174. This compares with $484,155 earned during the same month of 1914. Net earnings amounted to $219,966, this account last year being $206,853.

THE Chicago Savings Bank and Trust Company and Elston, Clifford and Co. have purchased $700,000 of St. Cloud Public Service Company 6% first mortgage bonds. The bonds are a first mortgage on all of the property of the company, which operates the gas, electric light, power and street railway utilities under exclusive franchises in St. Cloud, Minn., a city with a population of approximately 19,000. The earnings of the company for the fiscal year ended July 30 last were 2.3 times the interest charges on the bond issue. There is a sinking fund provision of 5% of gross earnings.

PACIFIC GAS AND ELECTRIC reports for twelve months ending August 31:

	1915.	Increase.
Operating revenues.....	$17,989,092	$1,338,486
Operating expenses.....	10,265,309	70,208
Net operating earnings....	7,723,783	1,268,278
Total dividend.....	890,627	290,627
Surplus.....	2,885,355	1,310,096

THOUGH a great many conservative investors deprecate the exciting trading in the highly speculative stocks that have had such large advances, and will buy none of them, they are not averse to buying what they call a semi-speculative investment stock, which is not subject to large fluctuations and whose dividend is assured. American Telephone and Telegraph, the preferred stocks of the American Tobacco Company, Liggett and Myers, American Car and Foundry preferred, and Central Leather preferred, Atchison and Union Pacific preferred, and St. Paul preferred have all come in for attention from this class of buyers, who have taken their purchases out of the market, having paid for them in full. The railroad preferred shares yield on an average around 5%, while the industrial preferred shares yield 6½%.

THE stock of the UTAH SECURITIES COMPANY has advanced in price, due to the improvement shown in its August report.

CONTENTS.

AN ASTERISK (*) DENOTES AN ILLUSTRATED ARTICLE.

*NEW APPARATUS FOR THE MANUFACTURE OF AQUA AMMONIA FROM RAW GAS LIQUOR, by R. W. Hilgenstock.. 241

ACCIDENTS THAT COULD HAVE BEEN PREVENTED, by J. B. Douglas..... 243

*THE ASTORIA TUNNEL UNDER THE EAST RIVER FOR GAS DISTRIBUTION IN NEW YORK CITY, by John V. Davies—[Continued from Page 230]..... 244

EDITORIALS..... 248
Talks on Safety—Reasonable Basis for Rates—Patent Litigation—The Best Securities—Annual Meeting, Empire State Gas and Electric Association—Institute Director's Meeting—Illuminating Engineering Society, Annual Meeting and New York Section Meeting.

DOMESTIC LIGHTING, by J. D. Shattuck..... 250

*LIGHTING WEEK—A SUCCESSFUL GAS SHOW—JERSEY CITY, N. J., by H. Thurston Owens,..... 252

PLATING BY IMPACT..... 253

*LIGHTING WEEK AT HAZELTON, PA., by J. H. Gaylord.. 253

Recent Patent Issues..... 253

TEMS OF INTEREST FROM VARIOUS LOCALITIES..... 254
Consolidated Company of Baltimore, Makes Good Showing—Emerson McMillen elected Chairman—Louisville (Ky.) Gas & Electric Co. Obtains Steam Heating Franchise—New Coke and Gas Plant at St. Paul, Minn.—St. Albans (Vt.) Gas Eight Co.'s Election—A. W. Evans, New Commercial Manager at Athol, Mass.—Columbia, Mo., $2 Rate Stands for the Present—Gas Rates for Los Angeles, Cal.—W. L. Doyle Does Heroic Work—Sioux City (Ia.) Gas and Electric Co., Amends Articles of Incorportion—George Light of Dayton, O., Elected General Manager—Portland (Ore.) Gas and Coke Company Tax—Alfred Clarke, President, Massachusetts Lighting Companies, Resigns—F. W. Freese Elected President of Consumers Gas Co., Princeton, Ind.—Lighting Districts for Salt Lake City—L. C. Hunt goes to Fort Madison, Ia,—Floral Park (N. Y.) to get Gas—Brown Instrument Co.'s New Factory—Fredonia, N. Y., Loses its Suit—Lighting Week at St. Louis, Mo., a Great Success—And Other Items.

NEW METHODS AND APPLIANCES..... 255
*Drains for Manholes—*Grips for Cables and Wires—Monel Metal Mystery.

Financial Notes..... 256

Public Lighting Table for Oct., 1915 (Ad. Section)..... 7

Meeting Times of the Various Gas Associations (Advertising Section)..... 21